HISTORY
of the
HONOLULU ENGINEER DISTRICT
1905 - 1965

U. S. ARMY ENGINEER DISTRICT, HONOLULU

FORT ARMSTRONG

HONOLULU, HAWAII

30 JUNE 1970

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 JAN 1970		**00-00-1970 to 00-00-1970**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
History of the Honolulu Engineer District 1905-1965	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Corps of Engineers,Honolulu District,Fort Shafter,HI,96858**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**164**	

HISTORY

of the

HONOLULU ENGINEER DISTRICT

1905 - 1965

by

Ellen van Hoften

U. S. ARMY ENGINEER DISTRICT, HONOLULU

FORT ARMSTRONG

HONOLULU, HAWAII

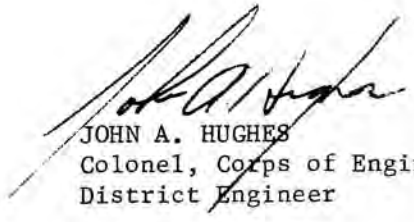
30 JUNE 1970

FOREWORD

The Honolulu District has a long and proud history. It is most fitting that a written account describing its accomplishments and problems over the decades has been compiled.

We were indeed fortunate to find a historian of the caliber of Mrs. van Hoften to do the necessary research and writing involved in the production of this history. She dedicated herself to the task and has produced a highly readable document. The manner in which she has equated District history with events and eras of national and international concern is particularly noteworthy.

I know that this history will be both interesting and useful to current and former District members alike. I am most pleased that its preparation occurred during my association with the Honolulu District.



JOHN A. HUGHES
Colonel, Corps of Engineers
District Engineer

PREFACE

The following history of the Honolulu Engineer District attempts to depict the major trends and patterns which developed in the District's first sixty years. Two themes run throughout the history: the variety and diversity of HED's activities, and the continued response of the District to national and world events. The aim of this history is to present an overview of significant areas of activity and to illustrate them by specific examples, rather than to include every project undertaken by HED. A description of several tasks performed in a given era should not imply that these jobs constituted the District's entire workload; they should be viewed instead as representative of HED's activity at that time. The history's organization carries out this aim, too: within each of the nine major time divisions, events and projects are covered topically, not chronologically, so that a general picture of the District's growth in that period may result. In the same way, a project not completed until a subsequent chapter may be discussed earlier to provide a comprehensive view of the project's development.

Two other points call for some clarification. Although this history covers the years from 1905 through 1965, first, many projects started in that period and completed between 1966 and early 1970 have been brought up to date. Secondly, throughout the narrative several terms are used almost synonymously: "the District" and "HED" refer to the Honolulu Engineer District, while "USED" or "U.S. Engineer Department" is used in the chapters on World War II to designate the combined forces of the Honolulu Engineer District and the other Engineer units which were associated temporarily with HED. When capitalized, "Engineers," "U.S. Engineers," and "Engineer Department" refer to Corps of Engineers members or specifically to the Honolulu Engineer District, usually as distinguished from state, county, or other local authorities.

A brief review of the highlights of Hawaii's history and geography may explain certain other terms used in this work. Until Queen Liliuokalani was deposed in 1893, the islands constituted a monarchy, while from 1894 to 1900 a republican form of government prevailed. Annexation to the United States took place in 1898, and with the passage of the Organic Act two years later Hawaii became a U.S. Territory, entitled to send one non-voting delegate to the U.S. Congress. Since Hawaii achieved statehood in 1959, references to the islands prior to that year are to "the Territory," while after 1959 the history speaks of "the State." "Hawaii," "the Hawaiian Islands," and "the islands" are used interchangeably throughout the text.

The islands are generally numbered at eight and include the four main islands of Kauai, Oahu, Maui, and Hawaii, in addition to the smaller islands of Niihau, Molokai, Lanai, and Kahoolawe. Since private interests own Niihau and since Kahoolawe is uninhabited, only the other six islands have seen Federal improvements. Oahu hosts four-fifths of the islands' total population, the State capital of Honolulu, most of Hawaii's military installations, and hence most of HED's projects. Largest in size, however, is the island of Hawaii, often called "the Big Island" to distinguish it from the State. The maps in Appendix B indicate the geographic relationship of Oahu to the "outer islands" and pinpoint the sites of some of the major civil and military projects constructed by HED. These maps and this preface should aid in interpreting the history of the Honolulu Engineer District.

INTRODUCTION

Of the many important eras which mark the first six decades of the history of the Honolulu Engineer District, World War II stands as a significant turning point. Until the 1940's the District's activities focused on civil works, with fortifications for island defense a secondary concern. As a result of the Corps' increased responsibilities during the Second World War and because of Hawaii's crucial role in that conflict, then, the emphasis of the Honolulu office after 1945 shifted from rivers and harbors to military construction. Although in the last twenty years civil works projects have regained their prewar importance, they have been matched in interest since World War II by a growing program of construction for the Army and the Air Force.

In civil works as well as in military projects, a wide variety of tasks has distinguished the Honolulu District. HED learned early in its history to dredge through hard coral beds, and most of the District's navigation projects have included the construction of breakwaters as well as the dredging of basins. During the busy decade of the 1930's, the District Engineer's responsibility for cutting through the reef at Midway was paralled by his supervision of the Public Works and Works Progress Administrations in Hawaii. After World War II the District expanded its civil works activities to include flood control and beach erosion protection and continued its investigations of lava barriers and tsunami-deflecting breakwaters near Hilo Harbor. More recently, a high explosive row charge cratering project at Kawaihae has joined the roster of HED's interesting tasks. Within the area of civil works, the Honolulu District's history has been marked by great diversity.

In military construction, likewise, HED has been involved in a wide variety of work. The seacoast fortifications erected in the District's first five years are only now being demolished to make room for a beach erosion project at Fort DeRussy. With the advent of World War II, the Honolulu Engineers assumed the greatest range of duties in HED's history: the conversion of private schools to offices and hospitals, the attempt to camouflage the famous Aloha Tower, and the paving of airfields on distant South Pacific islands attested to the flexibility and diversity of the Honolulu District. Current defense construction for anti-missile programs at Kwajalein has underscored the variety of HED's work, for the precision required to erect a radar building on Roi-Namur has been balanced by the landscaping talents called for in a housing project on Ebeye.

Geographically as well, variety has distinguished the Honolulu District. The 1930's witnessed the District's dredging at Midway; World War II saw Engineer planning and supply for bases as far away as New Caledonia; and the 1960's heralded new programs in the Marshall Islands. During most of its history, HED has extended its reach far into the Pacific Ocean.

In another sense, too, in its adaptability to the changing times, HED has exhibited great flexibility. Established partly as a consequence of Hawaii's annexation in 1898, the Honolulu office soon undertook the improvement of Honolulu Harbor in response to the construction of the Panama Canal and then turned to enlarging that harbor as the Canal was opened to traffic. The District's work at Midway was due to increased air commerce and the threat of enemy air attacks, while the District's tremendous defense program from 1939 to 1945 resulted from the global crises of those years. The continued development of air traffic in the decade after World War II had a similar effect on HED: in the area of military work the office stepped up its airfield construction, while in civil works the same air traffic resulted in increased tourism in Hawaii and in HED's participation in the field of beach erosion protection. Recent improvements of harbors on Hawaii's major islands have been made in response to the State's continued agricultural and industrial growth, while HED's work in Kwajalein has related directly to the current needs of national defense. The size of the District also has fluctuated throughout the century in accordance with world and national trends.

In these respects, then, the Honolulu Engineer District has served its Corps and its country. For sixty years HED's history has followed Hawaiian, American, and world history; for sixty years HED has exhibited great variety in its civil and military tasks. The following chapters focus on these two themes, the diversity and flexibility of the Honolulu Engineer District, in the first sixty years of its history.

CONTENTS

CHAPTER I: Big Guns and Harbors

In the establishment of the Honolulu Engineer District and the first five years of its operation is reflected sharply the changing relationship between Hawaii and the United States at the start of the twentieth century. Coastal defenses, harbor improvements at Honolulu and Hilo, and supervision of lighthouses and Engineer troops in the Hawaiian Islands were among the District Engineer's varied duties in these early years.

Before the opening of the Honolulu District in 1905, Engineer activities in Hawaii fell under the supervision of the U.S. Engineer office in San Francisco. The attempt to fortify and protect this new outpost of America began shortly after the annexation of Hawaii to the United States in July 1898. From 1899 through 1904 the Chief of Engineers urged the Secretary of War to approve plans and then to appropriate funds "for the defense of our insular possessions," and in his Annual Report of 1900 the Chief of Engineers announced that preliminary plans for the defense of Pearl Harbor and Honolulu had been completed. Pressure from the Navy to protect its insular coaling stations may have contributed to the Secretary's approval of this project in 1901 or 1902. The Fortification Act of 21 April 1904 provided $200,000 as the first appropriation for defense purposes in the Hawaiian Islands, while the organization of the National Coast Defense Board in January 1905 further evidenced the administration's determination to protect its coasts. Although these plans for the defense of the newly acquired Hawaiian Islands had been prepared in San Francisco, their implementation would call for an Engineer office in the new Territory itself.

Further post-annexation incentives for the establishment of an Engineer District in Honolulu came in the area of civil works. A project to dredge a channel through the Pearl Harbor bar was authorized in March 1899, only seven months after annexation; under the supervision of the Engineer office in San Francisco, dredging by contract began in March 1902 and was completed in August 1903. The resulting 30-foot deep and 200-foot wide channel provided safe passage for naval vessels but was not open to private commerce. Hence preliminary plans for the improvement of Honolulu Harbor were of greater concern to local interests than was the actual dredging of the Pearl Harbor channel, and the confusion over jurisdiction which arose during the attempt to establish harbor lines at Honolulu was no doubt partly responsible for the creation of an Engineer District in Hawaii.

Even before annexation, local interests on Oahu had sought to fix a permanent harbor line as a prerequisite to improvements in Honolulu Harbor. When annexation made the local government reluctant to establish such a boundary, an attorney for the Oahu Railway and Land Company, one of the island's major commercial concerns, requested in January 1899 that the U.S. Government establish the necessary harbor line. The Chief of Engineers hesitated to take action, however, since, although Hawaii had been annexed in 1898, until the passage of the Organic Act in April 1900 the islands' own laws were to remain in force. In February the Judge Adjutant General ruled that the U.S. River and Harbor Act of 1890 did prevail in Hawaii, so that the Secretary of War might indeed order harbor lines fixed in Honolulu. Since the Chief of Engineers had no representative in the Hawaiian Islands at that time, he suggested that the 3rd Battalion of the 2nd Regiment of U.S. Volunteer Engineers, stationed in Honolulu and responsible to the Commanding General of the Department of California, might take charge of the necessary survey. In accordance with his suggestion the Department of California convened a Board of Officers from the 3rd Battalion, under Major W. C. Langfitt, and the Board's report of April 1899 was approved by the Secretary of War within the next two months. When the Oahu Railway and Land Company requested a modification of the existing harbor lines in early 1900, another board of officers from the Engineer forces serving in Hawaii met to fix the new lines, which were approved in May 1900.

Thus harbor lines in Honolulu were first established, not by a representative of the Chief of Engineers, but by a board of officers responsible to a War Department command in California. This incident underscored the need for an Engineer District in Honolulu. Meanwhile, in 1900 and again in 1902, the Honolulu Chamber of Commerce urged Congress to authorize improvements for Honolulu Harbor. In a letter to the Chairman of the House Committee on Rivers and Harbors, on 21 October 1904, Governor George R. Carter acknowledged the feeling of many

in Hawaii that the Federal Government had not helped the territory sufficiently since annexation. The December 1902 visit to Hilo by a U.S. Senate Commission and the Senators' recommendation of a breakwater survey at Hilo drew further attention to the harbors of the Hawaiian Islands.

The requirements of both defense and commerce, then, contributed to the establishment of the Honolulu Engineer District less than six years after the islands were annexed. In November 1904 First Lieutenant John R. Slattery arrived in Hawaii to open the new office, and on 19 December he submitted his first report: a recommendation for the improvement of Honolulu Harbor at an estimated cost of approximately $1.5 million. When the office formally opened on 15 April 1905, First Lieutenant Slattery was involved in a resurvey of the same harbor. By the end of 1905 the Honolulu District Engineer was listed in the directory of Federal officials: "U.S. Engineer Office — First Lieutenant J. R. Slattery, Corps of Engineers, in charge of improvement of Pearl Harbor and harbor of Honolulu, including its resurvey, and survey of Hilo harbor, Hawaii."[1]

First Lieutenant Slattery set up his office in Room 65 of the Alexander Young Building on Bishop Street in downtown Honolulu. On 1 April 1907 his successor, Captain C. W. Otwell, moved the District office to Rooms 301-305 at the recently erected McCandless Building on the corner of King and Bethel Streets, a few blocks away from the Young Building. The office would remain here until the completion of the new Federal Building in 1922.

A small staff characterized the Honolulu District in these early years: listed in a late 1907 register under "Engineer Department" were Captain Otwell, an Assistant Engineer, a chief clerk, two Junior Engineers, one overseer, and one Receiver Materials. By the end of 1909 the Engineer Department had increased to a complement of twelve civilians under Major E. E. Winslow. In addition, the District Engineer supervised a Lighthouse District staff of four civilians and an Engineer Camp with five officers, whose duties are discussed below.

From 1905 to 1911 military work in the Honolulu District centered on construction of the coastal defenses which had been urged by the Chief of Engineers since 1899. Perhaps as a result of the U.S. President's suggestion in January 1906 that a large part of Hawaii's revenues and customs receipts be diverted to educational buildings and Federal fortifications in the Territory, the fortification appropriation act of that year provided an additional $260,000 for batteries in the islands, while for fiscal year 1908 the sum of $1,110,000 was allotted to fortify Honolulu and Pearl Harbors. Among the islands' seacoast defenses were gun batteries, searchlights, electrical installations, and submarine mines in both harbors.

Of these, new gun batteries at already existing forts provided the backbone of Hawaii's defense system at that time. War clouds gathering in the Mediterranean around 1905 may have contributed to America's determination to protect its newly acquired islands. As a 1910 article in a local magazine noted, "Now our Uncle Sam having come into possession of the Paradise of the Pacific has no idea of

The Alexander Young Building, Bishop Street, Honolulu, where the Honolulu Engineer District (HED) maintained its offices from 1905 to 1907 and again in 1941.

The McCandless Building, King and Bethel Streets, Honolulu, home of the HED offices from 1907 to 1922.

allowing it to get away from him."[2] Battery Harlow at Fort Ruger was completed in 1909 and turned over to the Coast Artillery Corps in March 1910; batteries Dudley and Randolph at Fort DeRussy joined the "chain of sentinels" in 1911; and other gun emplacements at Fort Armstrong were constructed during the same years. While guns at these three posts were to guard the gateway of Honolulu, mortars at Fort Kamehameha would defend Pearl Harbor from attack by enemy ships. The Honolulu District thus contributed early in its history to the demands of national defense.

In the area of civil works, too, the District responded to events across the world. The start of construction on the Panama Canal in 1904 heralded increased commerce between eastern America and the Orient, and Hawaii hoped that this commerce would include Honolulu Harbor as a port of call. Although earlier dredging by the Monarchy and the Republic had enlarged the natural harbor to a depth of 27 feet and had provided an entrance channel 200 feet wide, a harbor of this size could not serve large transpacific vessels. Thus the River and Harbor Act of 3 March 1905 adopted First Lieutenant Slattery's earlier recommendations and authorized the enlargement of the harbor to a depth of 35 feet and a general width of 1,200 feet. The entrance channel was to be dredged to 35 feet deep and 400 feet wide at the lighthouse point, which was to be cut off to ease the channel curve. First Lieutenant Slattery's resurvey report of June 1905 set the estimated cost for new work at $1,628,895 plus $30,000 for a new range light.

Dredging of Honolulu Harbor by contract began in November 1905 and was completed in July 1906; further work was done under a second contract between February and December 1908. Both contractors encountered unanticipated shelves of solid rock and hard coral along the edges of the entrance channel. By the time the appropriated funds of $800,000 were exhausted in December 1908, a total of 1,910,023 cubic yards had been excavated from Honolulu Harbor, the lighthouse point had been removed, the entrance channel had been enlarged to project dimensions, and the harbor had been dredged to a depth of 35 feet. Related, concurrent work involved several reclamation projects. As anticipated, enlarging the small island just seaward of the lighthouse calmed the entire harbor; indeed, continued reclamation of this land, today known as Sand Island, has eliminated the need for a breakwater in Honolulu Harbor. Shoreline lands of the Dowsett Company and the Oahu Railway and Land Company were reclaimed in exchange for assurances of future Federal purchases of other company property. A separate project to reclaim Quarantine Island, a low, swampy area on a reef in the harbor, was adopted in February 1906 and was carried out by contract until funds were exhausted in March 1908. Continued reclamation over the next four decades would result in the absorption of Quarantine Island into an enlarged Sand Island.

In 1909, when the original Honolulu Harbor project was half completed and appropriated funds had been depleted, the District Engineer recommended that further operations at Honolulu rest in abeyance until other Hawaiian harbors could be similarly improved. Accordingly, work continued at Hilo Harbor

on the Big Island of Hawaii, and the next decade saw the authorization of projects at Kahului, on Maui, and at Nawiliwili, on Kauai.

Whereas the initial improvement at Honolulu focused on dredging and reclaiming, work at Hilo Harbor centered on constructing a rubblemound breakwater. Prior to the start of Federal improvements the District Engineer described Hilo Bay at "an open roadstead, protected to a limited extent by Blonde Reef, but otherwise exposed . . ."[3] The River and Harbor Act of 3 March 1905 which authorized the initial project for Honolulu Harbor also called for a preliminary survey of Hilo Harbor with a view to building a breakwater along Blonde Reef. First Lieutenant Slattery considered barriers of concrete and rubble, of concrete, and of rubble alone and in December 1906 settled on a rubble structure whose cost he estimated at $1,700,000. The District Engineer admitted that construction of the breakwater was not justified by present commerce, but he urged the improvement as a necessary prerequisite to railroad development on the island. To strengthen his case, First Lieutenant Slattery sent the Chief of Engineers samples of the abundant lava rock available for quarrying near Hilo.

Disagreeing with First Lieutenant Slattery's arguments in favor of improvements at Hilo Harbor was the South Pacific Division Engineer, Colonel W. H. Heuer. Colonel Heuer opposed the construction of the breakwater on three grounds: first, as the Honolulu District Engineer had also noted, Colonel Heuer determined that present commerce at Hilo did not warrant the improvement; secondly, the Division Engineer considered the proposed breakwater construction weak and felt that the barrier would provide only a small and imperfectly protected harbor. Colonel Heuer also anticipated that the cost of construction would rise above First Lieutenant Slattery's estimate of $1,700,000. In spite of the Division Engineer's opposition, however, the project to construct a rubblemound breakwater 10,170 feet long on Blonde Reef was adopted by the River and Harbor Act of 2 March 1907. In September 1908 construction began under contract; by 30 June 1910, $600,000 had been appropriated and 12 per cent of the breakwater was completed. The project modification discussed in the next chapter would alter the completion date originally set for July 1911.

The major civil works activities of the Honolulu District from 1905 to 1910 consisted of planning and constructing these improvements at Honolulu and Hilo Harbors. A small but interesting project of the same period was the removal of the **Martha Davis**, an American bark which burned and sank in Hilo Harbor in May 1905, less than a month after First Lieutenant Slattery opened his office. When bids for the bark's removal were determined excessive, one of the bidders offered to dredge the sand out from beneath the **Davis** so that she would settle into the harbor bottom, at an acceptable cost of $4,000. In May 1906 the contractor completed his work, towed part of the wreck to shore, and buried the rest in the sand. Harbor sweeping then showed the site to be free of obstruction. Though not important in terms of future harbor development, this task provided an early example of the ingenuity and variety of work which were to characterize the Honolulu District. In the same way, the unfavorable recommendation First Lieutenant Slattery made in August 1905 on improvements at Welles Harbor, Midway, may not

Gun mortars constructed at Battery Harlow, Fort Ruger, Honolulu, in 1909.

have been significant in itself but served as background for the District's development of Midway in the 1930's. This survey, called for by the same River and Harbor Act of 1905 which had authorized similar studies at Honolulu and Hilo, also indicated the broad geographic scope of the District's activities even in its earliest years.

For these civil works and fortification projects the Honolulu District Engineer reported to the Chief of Engineers through the South Pacific Division. In his duties as Lighthouse Engineer in Hawaii, however, First Lieutenant Slattery was responsible to the Secretary of Labor and Commerce through the U.S. Lighthouse Board. In 1852 the Corps of Engineers had taken charge of building and renovating lighthouses in the United States; later in that century, one Army Engineer officer had been detailed to each of the 12 Lighthouse Districts as Lighthouse Engineer. When Hawaii joined the U.S., then, local interests urged the Federal Government to take over the islands' lights. Congress agreed and by January 1904 had created a Hawaiian Lighthouse Subdivision under the jurisdiction of the 12th Lighthouse District in California.

When he arrived in the Territory in late 1904, First Lieutenant Slattery found that as an officer of the Corps of Engineers his responsibilities would include the Hawaiian Lighthouse Subdivision as well as the Honolulu Engineer District. In theory he maintained separate staffs and stationery; in practice, some personnel listed under the Engineer Department were also employed in the Lighthouse Subdivision. Among the 19 or 20 lights whose administration First Lieutenant Slattery acquired were those at Diamond Head, Nawiliwili, and Molokai Point. The harbor improvements at Honolulu which necessitated the removal and relocation of the harbor entrance light dovetailed with the District Engineer's duties as Lighthouse Engineer. First Lieutenant Slattery's biggest lighthouse project involved plans for a new light 420 feet above the water at Makapuu Point on Oahu. Captain Otwell's tour saw the start of the lighthouse's construction, while Major Winslow supervised the completion of the Makapuu light in 1909. The lighthouse is still in operation and stands as a landmark on the southeast point of Oahu.

On 17 June 1910 an act of Congress established the Bureau of Lighthouses under a civilian staff, designated the Corps of Engineers as consultants rather than administrators, and thereby relieved Major Winslow of his lighthouse duties. For five years the Honolulu District Engineer's activities had included the administration of lighthouses in the Territory of Hawaii. The construction of the Makapuu light, while perhaps not the most unusual task ever accomplished by the office, did exemplify the variety of the Honolulu District's endeavors.

A dearth of Engineer officers in Hawaii may have been responsible for the Honolulu District Engineer's lighthouse duties and for his assignment as

Makapuu Point Lighthouse, Oahu, in 1934.

commanding officer of Hawaii's Engineer troops as well. Major Winslow assumed command of Engineer Company A soon after the troops arrived at Fort DeRussy in November 1908; with a staff of one Captain and four Lieutenants, the Major directed mapping and surveying operations on Oahu. The troops' dredging and filling of the Fort DeRussy area during the next three years had special interest for the District's history, for this work by the soldiers anticipated by 30 years the District Engineer's supervision of Engineer troops in the Second World War. In addition, the resulting reclaimed land would later host recreational facilities erected by Major Winslow's successors. Although this project would be classified as military construction rather than as civil works, its dredging and filling aspects paralleled today's beach erosion protection operations at the same location.

During the first five years of the Honolulu District's history, then, the District Engineer served as well as Lighthouse Engineer and as commanding of-

Captain Curtis W. Otwell and his noncommissioned staff, Company A, Corps of Engineers, at Fort DeRussy in 1908.

ficer of Engineer troops in Hawaii. His responsibilities ranged from the construction of gun mortars and breakwaters to the administration of lighthouses and dredging operations by the troops. Hawaii's annexation had prompted the establishment of the District office; America's defense and commercial requirements then focused the District's attention on fortifications and harbor improvements; while a scarcity of Engineer officers in the new Territory generated additional tasks for the District Engineer. Even in its formative years, the Honolulu District was distinguished by diversity.

Footnotes — Chapter 1

1. Thomas G. Thrum, **The Hawaiian Annual**, 1906, p. 223.
2. John S. Johnston, Capt., C.A.C., "Fort Ruger: The Sentinel at the Gate," **Paradise of the Pacific**, January 1911, p. 10.
3. **Annual Report of the Chief of Engineers on Civil Works Activities**, 1907, I, 805.

CHAPTER II: A Decade of Gradual Growth

The decade from 1910 to 1920 witnessed the gradual consolidation and expansion of the Honolulu Engineer District. By 1913 most of Oahu's gun batteries were constructed, and late that year the District Engineer surrendered his command of the Engineer troops to an assistant. During this ten year period Congress authorized further dredging at both Honolulu and Hilo Harbors as well as new navigation projects at Kahului and Nawiliwili. The decade was characterized, therefore, by a slight shift in emphasis from defense construction to civil works.

While Engineer Department headquarters remained in the McCandless Building during this entire period, several field offices were established elsewhere on Oahu. In 1911 the telephone directory listed additional branches at Fort DeRussy and Fort Armstrong, quarries at Moiliili and Pahoa, and a storehouse on Queen Street. In 1917 the storehouse moved to Channel Street, near Pier 2, and an Engineer Depot which had opened in 1911 was relocated at Fort Shafter. The District Engineer supervised a small staff of one or two military assistants and a dozen civilians until 1919, when wartime attrition was probably responsible for the reassignment of the officers and the reduction of the civilian complement to eight.

The following roster shows that the command of the Engineer Department in Hawaii passed through nine different officers in a period of ten years:

Honolulu District Engineers

Major E. E. Winslow
November 1908 — March 1911
Captain A. B. Putnam
March 1911 — July 1911
Major W. P. Wooten
July 1911 — July 1914
Lieutenant Colonel C. S. Bromwell
July 1914 — December 1915
Captain C. J. Taylor
December 1915 — February 1916
Major R. R. Raymond
February 1916 — September 1917
Captain W. H. Britton
September 1917 — November 1917
Colonel T. H. Rees
November 1917 — December 1917
Captain W. H. Britton
December 1917 — January 1918
Lieutenant Colonel R. R. Raymond
January 1918 — March 1919
Colonel H. C. Newcomer
March 1919 — August 1920

Perhaps because of the heavy personnel demands of World War I, rapid turnover between 1915 and 1920 characterized many Corps of Engineers units at that time.

A scarcity of Engineer officers may also have been the reason for the District Engineer's additional assignment from 1913 to 1926 as Department Engineer on the staff of the Hawaiian Department. Until October 1910 all military posts in the islands had been separate units under the jurisdiction of the Department of California; War Department orders from 1910 to 1913 led to the creation of the Hawaiian Department as an independent command with its own staff of officers. Thus three years after he hung up his Lighthouse Engineer's hat, the District Engineer donned that of Department Engineer. In this capacity Major Wooten and his successors maintained a separate, military staff and reported to the Commanding Officer of the Hawaiian Department, not to the Chief of Engineers. The Corps of Engineers officer assigned in 1916 as "Assistant to the Department Engineer" presumably relieved the Department Engineer of many staff duties. Local residents must have found it difficult to believe that acting as "Department Engineer" was not at all the same as representing the U.S. "Engineer Department" — especially when one man served in both capacities. The situation provided an interesting precedent for the merger of the two jobs during World War II, when once again the senior Engineer officer in the islands would act as both District and Department Engineer.

Also affected by the creation of the Hawaiian Department in 1913 was the Engineer Department's relationship with the Engineer troops. Although he relinquished direct command of Engineer soldiers in the islands in 1913, throughout the decade the District Engineer continued some operations with troop assistance. An Engineer company had begun a military survey of Oahu in June of 1913; the soldiers continued their mapping under Major Wooten's direc-

tion through June of 1914. Annual Reports for the Chief of Engineers for 1917, 1918, and 1919 referred to additional road surveys on Oahu "done by Engineer troops." In addition, the District Engineer continued to supervise the Engineer Depot established in 1911 for assembling and issuing Engineer supplies to various troops stationed near Honolulu. In 1917 Engineer troops built the Engineer Depot storehouse at Fort Shafter. The District Engineer's responsibility for supplying the troops in the islands throughout this decade heralded a similar situation during World War II and illustrated the close relationship maintained between 1913 and 1920 among Engineer activities in Hawaii.

These supply functions were accompanied by continued fortification duties, although defense activity as a whole decreased between 1910 and 1920. After 1913, when the gun mortars at the four Oahu forts had been completed and turned over to the Coast Artillery Corps, most of the District's fortification work consisted of installing electrical equipment, acquiring land for future defense sites, and providing access to Oahu's batteries. New defense items were introduced by the Fortification Act of 3 March 1915, which appropriated $21,000 for a defensive seawall along Honolulu Harbor, and by that of 8 July 1918, which set aside $30,000 for construction of a concrete wharf. In contrast to the Second World War, which was to reshape the District's military functions dramatically, World War I, a primarily European conflict which the United States entered relatively late, seemed to have little effect on the defense activities of the Honolulu District.

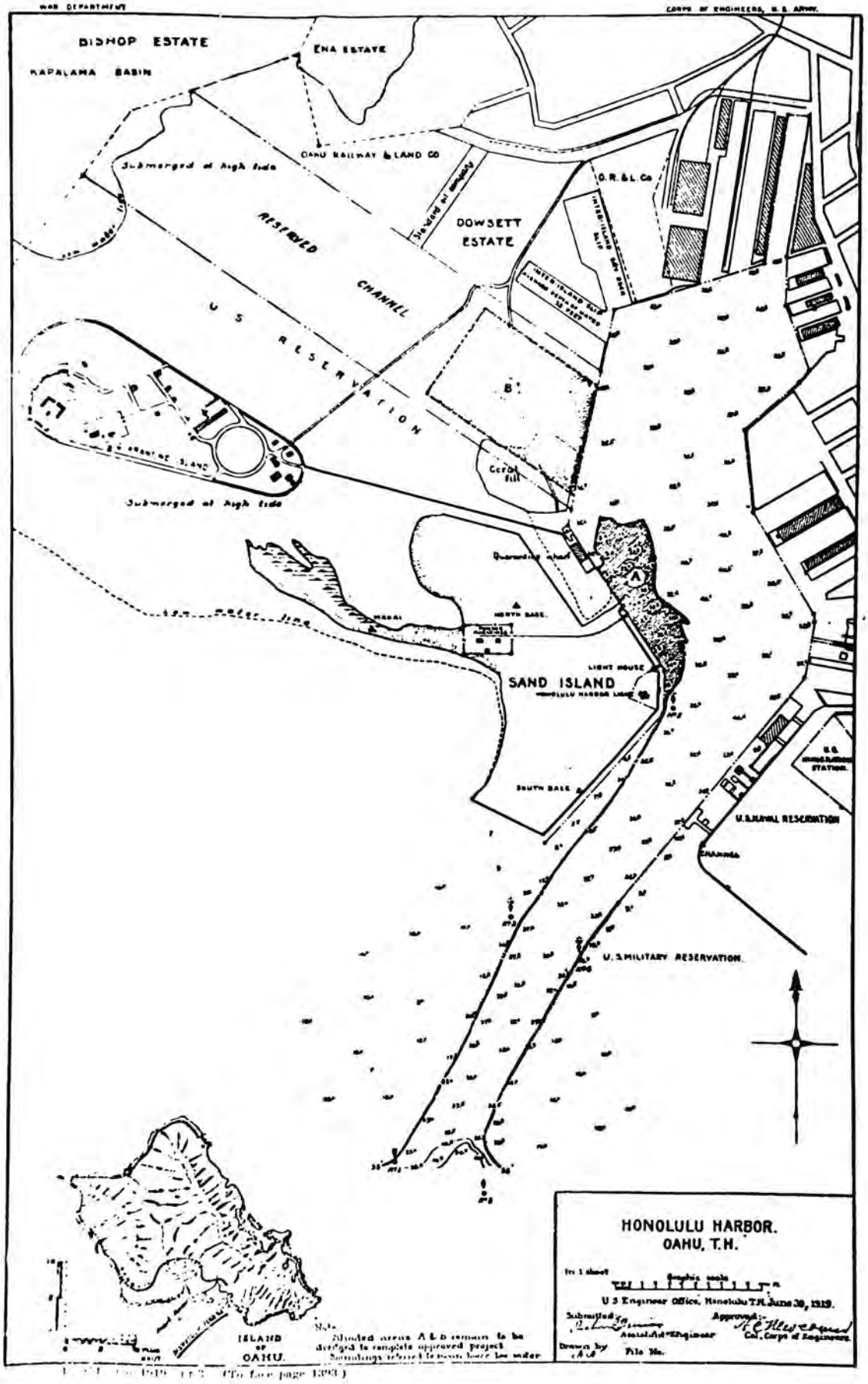
Civil works projects in this decade included those already initiated on Oahu and Hawaii and new operations on Maui and Kauai. Little work was done at Honolulu between 1910 and 1913, probably as a result of the District Engineer's recommendation in 1910 that the Federal Government move on to other island harbors; in 1910 and 1911 a local contractor removed approximately 150,000 cubic yards from the north end of Honolulu Harbor, and in 1912 a mainland company began maintenance and redredging of shoaled areas in the channel. With additional appropriations granted by the March 1913 River and Harbor Act, however, another contract was awarded that July for continued widening of the harbor basin. Thus by 30 June 1915 over 70 per cent of the project had been completed. Tonnage had increased from 1,808,219 in 1906 to 4,564,588 in 1914, while the commercial value of shipping through the harbor had risen from $31,781,816 in 1906 to $77,695,792 eight years later.

The opening to traffic of the Panama Canal in August 1914 was partly responsible for this increased commerce, since ships passing through the Canal en route to the Orient stopped for coal and fuel oil at Honolulu. At the same time, the completion of the Canal signaled even greater commerce in the future and seemed to call for the further enlargement of Honolulu Harbor. Even before the original project was completed, the River and Harbor Act of 4 March 1913 called for a report on Kalihi Harbor and Channel in response to local requests for more wharfage space. At hearings held in April and May, many Honolulu merchants favored dredging this channel to create a second, or western entrance to Honolulu Harbor. Kapalama Basin, within Kalihi Harbor, would presumably be dredged at the same time, to provide the needed additional wharfage facilities. These suggested improvements were considered as an extension of the existing harbor rather than as a separate project.

Although initially favorable to expanding Honolulu Harbor to the west in this fashion, Major Wooten finally recommended that Kalihi Channel not be dredged. His report of 5 January 1914 cited the difficulty of defending two separate harbor entrances as the major obstacle to the proposed project. Instead, the District Engineer recommended opening the "Reserved Channel" which lay between the Honolulu waterfront and Sand Island, in order to provide access to Kapalama Basin from Honolulu Harbor itself. Deepening the Reserved Channel to 35 feet over a width of 400 feet and dredging a 1,000-foot square turning basin at Kapalama would thus make additional wharfage space possible without creating a second entrance channel.

The reluctance of the Board of Engineers for Rivers and Harbors to concur in Major Wooten's recommendations was met by the determination of the Honolulu Chamber of Commerce to see the harbor enlarged. A 1914 report by the Chamber's Committee on Maritime Affairs recalled that only five battleships of the fleet sent around the world in 1908 had been able to enter Honolulu Harbor at one time; the Committee noted the increase in commerce anticipated because of the opening of the Panama Canal; and the Chamber, supported by Governor Walter F. Frear, urged Lieutenant Colonel Bromwell's further study of the proposed expansion. In his report of 30 November 1914 the District Engineer recommended increasing the proposed width of the Reserved Channel to 1,000 feet. After almost three more years of discussion and compromise, the River and Harbor Act of 8 August 1917 modified the Honolulu Harbor project by authorizing the dredging of the Reserved Channel to 35 feet deep, 800 feet wide, and 1,000 feet long. Improving the harbor basin at Kapalama was left to local interests.

Under a contract awarded in October 1919, 54,819 cubic yards were removed from the Reserved Channel by the end of June 1920, when the entire Honolulu Harbor project was 69 per cent completed. Dredging continued at the same time in the area formerly occupied by the Quarantine Wharf, as part of the original project. Perhaps as a result of financial preoccupation with the World War, dredging progress at Honolulu in these years was slow. In November 1919 the District Engineer recommended that no additional authorizations be made at that time for the improvement of Honolulu Harbor. Construction



Map of Honolulu Harbor in 1919. See also 1932 map on page 20 for location of Kalihi Channel and Kapalama Basin, to the west of Quarantine Island.

of the modified project for Honolulu would continue into the next decade.

The attention given here to these plans for Honolulu Harbor is warranted in two respects. Although not authorized as a civil works project until 1954 and not completed until 1962, a second entrance to Honolulu Harbor had been considered as early as 1913 — almost half a century before the entrance was actually constructed. In fact, the theme of Kalihi Channel runs through most of the District's history, for initial work on the channel and Federal dredging in Kapalama Basin were undertaken as defense measures during World War II. In addition, the step-by-step development of Honolulu Harbor was representative of many District harbor projects. Just as the Reserved Channel portion of the harbor was authorized before the original dredging was finished, so most of Hawaii's Federal harbor projects have been modified before the initially authorized construction has been completed. Also typical of this pattern, for instance, was the development of Hilo Harbor between 1910 and 1920. Work had begun by contract in May 1908 on the original project, which provided for a rubblemound breakwater 10,170 feet long on Blonde Reef. By 30 June 1911, 2,528 feet of breakwater and 315 feet of substructure had been placed, the project was 14 per cent completed, and protection could be noticed in the eastern harbor.

Meanwhile, the River and Harbor Act of February 1911 had called for a resurvey of Hilo Harbor, since larger vessels and greater traffic would require increased commercial facilities. Major Wooten's report of December 1911 recommended extending the breakwater only as far as possible within the original cost limits while dredging to 35 feet deep the entrance to Kuhio Bay, at an additional estimated cost of $76,000. His suggestions were adopted by the River and Harbor Act of 25 July 1912, and construction of the breakwater and dredging of the harbor continued under the revised project authorization. At the time of this modification the breakwater project was 35 per cent completed; by mid-1915 the modified project, which provided now for a breakwater only 7,000 feet long instead of the originally authorized length of 10,170 feet, was almost half done. Vessels requiring depths of 33 feet could enter the bay at that point but were not sufficiently protected while lying at the Territorial wharf. By July 1918, however, the breakwater provided a smooth harbor in good weather and allowed large vessels to moor at the wharf.

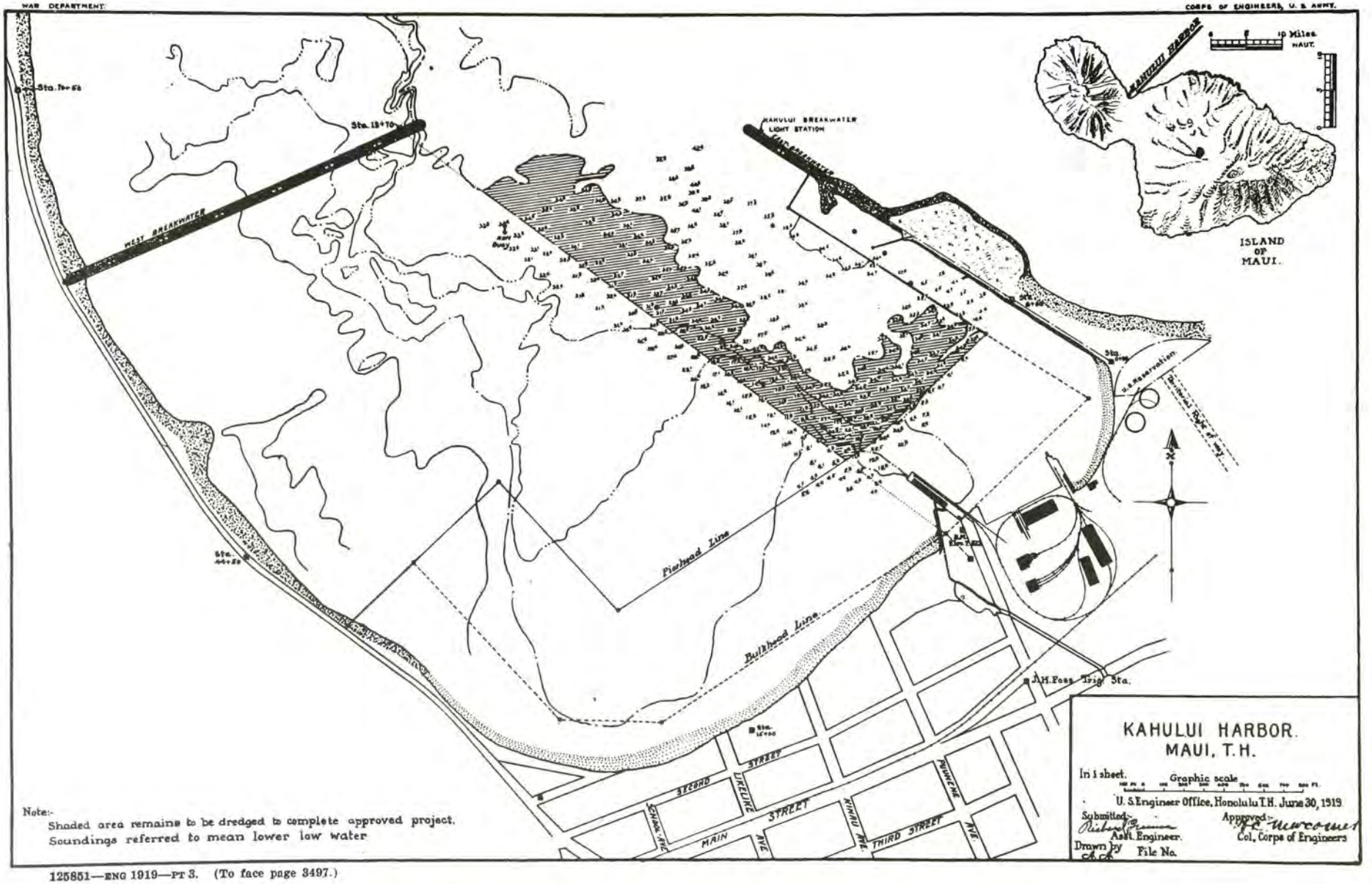
Had World War I not curtailed civil works funds, the Hilo Harbor project might have been completed by the end of the decade. An article in an early 1919 San Francisco magazine urged Lieutenant Colonel Raymond to continue the port's development so that Hilo could share with Honolulu the anticipated postwar shipping and tourist boom,[1] and the District Engineer seemed to agree on the importance of improving Hawaii's second harbor. Yet no money for Hilo had been appropriated between 1913 and 1918. Because of a lack of funds, therefore, all new work on the harbor ceased by June 1919, and the project at Hilo, like that at Honolulu, would await completion ten years later.

Although dredging was added to the Hilo Harbor project in 1912, breakwater construction remained the distinctive feature of most of Hawaii's harbors. At Kahului, for instance, both a breakwater and a harbor basin were included as part of the original project, and a second breakwater was added in the same decade. The District Engineer conducted surveys of both Maalaea and Kahului Harbors on Maui in accordance with the River and Harbor Act of 3 March 1909. Located on the southwest shore and therefore less exposed than Kahului, Maalaea was nevertheless rejected because the surrounding mountains created a funneling of trade winds in the bay. Furthermore, the Kahului Railroad Company had already improved Kahului Harbor at its own expense by constructing an 1,800-foot long breakwater on the eastern side of the harbor and by dredging 300,000 cubic yards from the harbor area protected by the breakwater. For these reasons, Kahului was selected as the site for Maui's harbor, while Maalaea was not reconsidered until much later in the District's history.

Major Winslow suggested four possible projects in his reports of June and November 1909. The plan adopted by the River and Harbor Act of 25 June 1910 provided for extending the already constructed breakwater to American Girl Rock and dredging both the eastern and the western harbor areas to depths of 35 feet. The Kahului Railroad Company was to cede to the United States free of charge all rights in the existing breakwater.

With funds appropriated annually from 1909 through 1915, the harbor was constructed in four stages. From April 1911 to March 1912, contractors placed 75,000 tons to strengthen the old breakwater and to extend its length from 1,703 feet to 2,150 feet. Dredging then began in May 1912 and continued until June of the next year, by which time 241,518 cubic yards had been removed. To repair 450 feet of breakwater damaged by storms during construction, additional work on the structure was performed between February and July 1913. And 89,000 cubic yards were dredged from the remaining harbor area between December 1913 and May 1914, when the existing project was completed. The total expenditure of $373,818 had created a harbor basin of 22 acres in area and 35 feet in depth protected by a breakwater 2,221 feet in length. The value of commerce at Kahului Harbor had meanwhile risen from $1.8 million in 1908 to over $13 million in 1914.

The storm damage suffered by the breakwater during construction was followed by severe shoaling within the first year after the project's completion, and similar maintenance problems continued at Kahului throughout the District's history. The River and Harbor Act of 27 July 1916 authorized construc-



125851—ENG 1919—PT 3. (To face page 3497.)

Map of Kahului Harbor, 1919.

tion of a west breakwater to divert the littoral current which caused the harbor shoaling. At the same time, the harbor basin was to be enlarged to 31 acres in area and 900 feet in width. The second breakwater was constructed by the end of fiscal year 1919, while the final dredging of the enlarged basin in November of that year signaled the completion of the modified harbor project. The development of Kahului Harbor thus differed in two respects from that of Honolulu or Hilo. The original project was completed within four years of authorization and the modified project only five years after the west breakwater had been adopted, first of all, in contrast to more gradual growth over longer periods of time at Honolulu and Hilo. Secondly, because of shoaling and storm damage to the breakwater, Kahului Harbor soon needed and would continue to require considerably more maintenance than the other two ports.

In spite of the slight lag in civil works appropriations in the second half of the decade, then, the commercial growth of Hawaii's major islands prompted the development of these harbors at Honolulu, Hilo, and Kahului. In addition, a Federal harbor project for Kauai was authorized in 1919. The same River and Harbor Act of 3 March 1909 which had called for a survey of Kahului Harbor also required a report on Hanapepe Bay on the south shore of Kauai. In the course of his initial survey in 1909, Major Winslow learned of some local opposition to locating the Federal harbor at Hanapepe and accordingly requested authority to examine other Kauai ports as well. Among the potential harbors investigated under the River and Harbor Act of 25 June 1910, then, were Hanalei, Kilauea, Anahola, Nawiliwili, Koloa, Hanapepe, and Waimea. The District Engineer's report of November 1910 narrowed the choices to three: Nawiliwili, Koloa, and Hanapepe.

Further studies easily eliminated Koloa as too costly, and during the next two years representatives of several major sugar plantations and shipping companies expressed their preferences for either Port Allen (adjacent to Hanapepe) or Nawiliwili. By December 1911 the two ports seemed evenly favored. Major Wooten concluded at that point that construction of the harbor at Nawiliwili would result in greater freight savings, more secure convenience for more passengers, and less expensive maintenance than would a harbor project at Hanapepe. After Matson Navigation Company submitted arguments in favor of Hanapepe to the Board of Engineers, however, in 1912 the Board also opted for Hanapepe — while the Chief of Engineers stated that he preferred Nawiliwili.

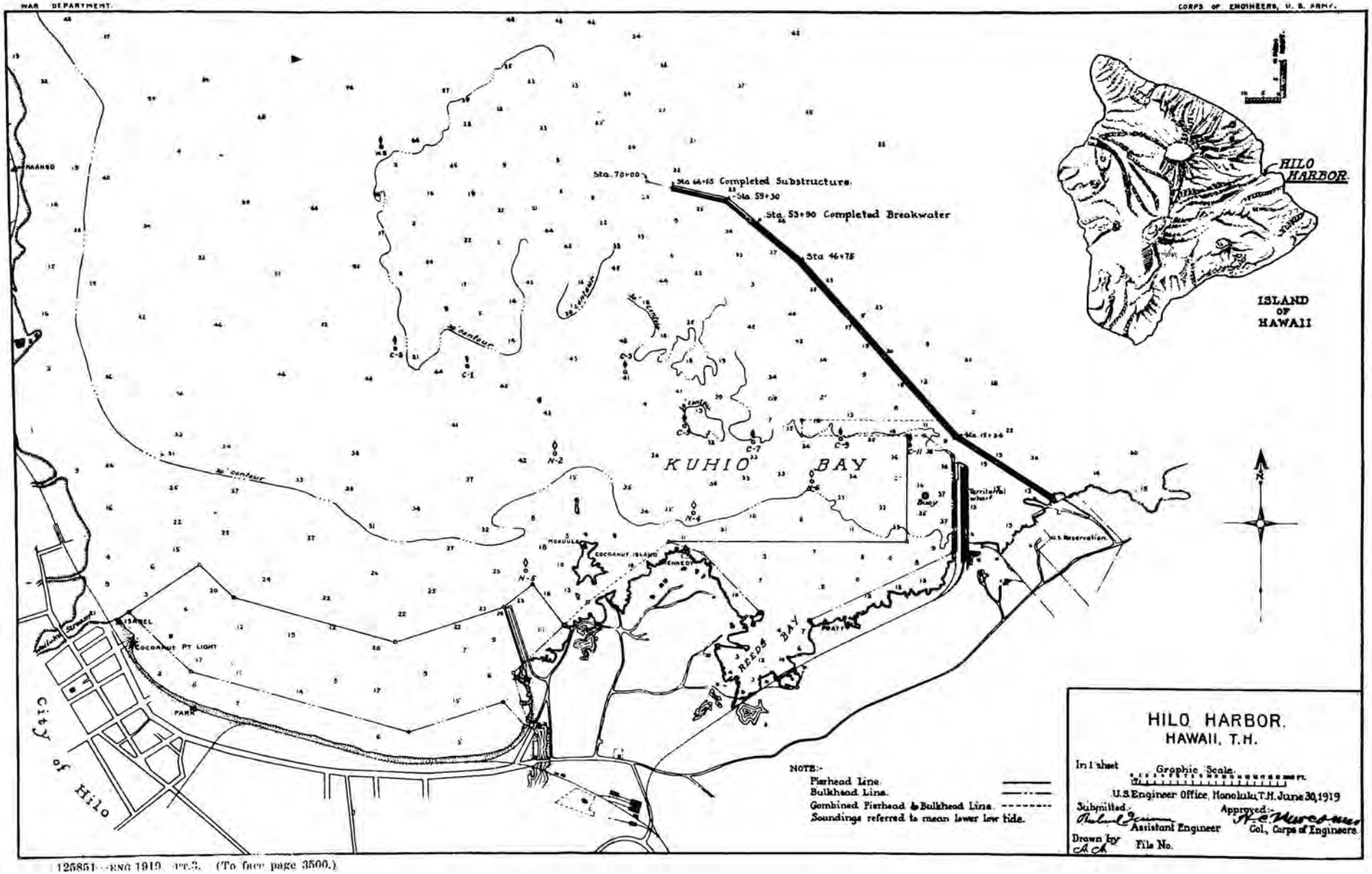
Successive District Engineers confirmed Major Wooten's choice, and after the war the River and Harbor Act of 2 March 1919 authorized his proposed project for Nawiliwili. Upon completion of a rubble-mound breakwater 2,450 feet long along the reef dividing the inner and outer harbors, the entrance channel would be dredged to a depth of 35 feet, a minimum width of 400 feet, and a length of 2,400 feet. Also included in the estimated cost of $1,086,000 was a harbor basin 35 feet deep, 1,025 feet wide, and averaging 2,000 feet in length. The same act provided an initial appropriation of $250,000 for construction of the harbor. Local interests were to assure eventual railroad connections between Nawiliwili and the southern part of the island "in reasonable time," while the Territory of Hawaii or the County of Kauai was to give the Secretary of War $200,000 toward the project. The first of these requirements would be involved in the next decade's dispute over Kauai's Federal harbor development; the second marked the first time a cash contribution had been required of local interests for a Federal navigation project in the Honolulu District. Partly because of a delay in delivering the $200,000 to the Federal Government, construction of Nawiliwili Harbor did not begin until the next decade.

The debate over the location of Kauai's Federal harbor surfaced again within four years and was settled only in the 1930's, when an additional harbor was constructed at Port Allen with Federal funds. All concerned had admitted the advantages of their opponents' claims: Nawiliwili's lower cost was met by Hanapepe's proximity to the sugar fields. As a result of the near toss-up, Kauai — smallest of Hawaii's four major islands and last to acquire one Federal harbor — would later be the first to claim two Federally dredged ports.

Civil works projects on Oahu, Hawaii, Maui, and Kauai thus occupied much of the Honolulu District Engineers' time from 1910 to 1920. No longer in command of Engineer troops in Hawaii nor responsible for lighthouse administration, the District Engineer did serve as Department Engineer and in both these capacities directed various defense activities in the islands. Yet by 1920 the District's functions centered on civil works rather than on fortifications. The Federal harbors at Honolulu, Hilo, Kahului, and Nawiliwili, all authorized by the end of this decade, would provide the backbone of the Territory's commercial development for the next forty years. Since only one navigable river lay within the jurisdiction of the Honolulu District, too, further improvement and maintenance of these four harbors would constitute the main features of the District's civil works activity for the same period of time. The slight stress on civil works rather than fortification projects first noticed between 1910 and 1920 would become even more pronounced during the following decade.

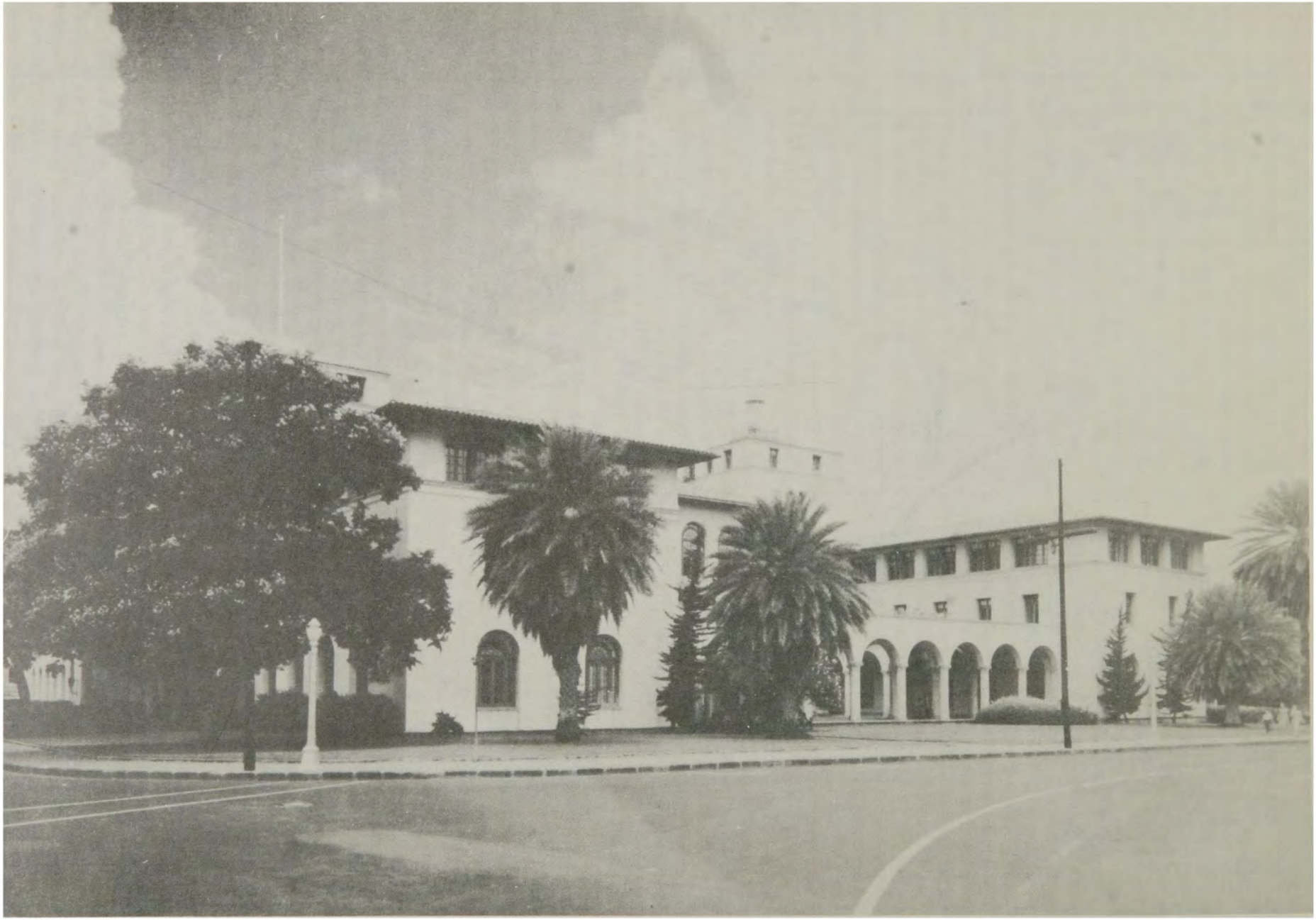
Footnote — Chapter II

1. George Mellon, "The Port of Hilo, Hawaii," **Pan-Pacific Magazine of San Francisco**, in **Paradise of the Pacific**, February 1919, p. 21.



125851---ENG 1919 Pt. 3. (To face page 3500.)

Map of Hilo Harbor, 1919.



The Federal Building, Richards and Merchant Streets, Honolulu, where the Honolulu Engineer District maintained its offices from 1922 to 1938.

CHAPTER III: Consolidation

Perhaps because of postwar economic conditions, the years from 1920 to 1931 in the Honolulu District were characterized by a comparatively slow pace of activity which affected both fortification and navigation projects in the islands. At the same time, the emphasis continued to shift from military construction to civil works as existing projects at three of the four major harbors were completed.

Changes of command occurred almost as frequently as they had during the previous ten years, although a close examination of the following list suggests that several of the officers may have served as temporary or acting District Engineers. Captain Underwood, Colonel Shulz, and Captain Damon, for example, each held the post for only a few months:

Honolulu District Engineers

Colonel H. C. Newcomer
March 1919 — August 1920
Colonel C. A. F. Flagler
August 1920 — January 1921
Captain H. M. Underwood
January 1921 — February 1921
Colonel C. A. F. Flagler
February 1921 — March 1921
Major W. A. Johnson
March 1921 — October 1923
Colonel Edward H. Schulz
October 1923 — November 1923
Major W. H. Lanagan
November 1923 — March 1926
Major W. C. Lemen
March 1926 — September 1926
Major Earl North
September 1926 — May 1929
Captain S. L. Damon
May 1929 — September 1929
Major R. W. Crawford
September 1929 — September 1931

Soon after the completion of Honolulu's new Federal Building, in 1922, the Engineers moved from their old offices in the McCandless Building to Room 214 in the new structure at Richards and Merchant Streets. By the time the District left the Federal Building in 1938 its offices occupied almost half of the second floor. The storehouse meanwhile remained at the Channel Street wharf, also in the area of downtown Honolulu.

Few figures are available to indicate the size of the staff or of the District's workload in these years. By the early 1920's a civilian assistant rather than the District Engineer himself drew the harbor maps for insertion in the annual reports. A feature in the March 1924 issue of **Paradise of the Pacific** stated that the Engineer Department had spent "nearly a quarter of a million" dollars in 1923 on harbor improvements and fortification repairs in Hawaii,[1] while a newspaper article two years later labeled the $1.4 million favored by Major Lanagan for three Hawaiian harbors "a record sum."[2] These references imply some growth within the District between 1920 and 1931.

The decade's most significant administrative changes involved the District's relationship with the Engineer office of the Hawaiian Department. In 1913 the District Engineer had assumed the additional job of Department Engineer; in 1926 these posts were once again delegated to two men. The last officer in this era to hold both positions simultaneously was Major Lemen, who continued as Department Engineer after Major North relieved him as District Engineer in September 1926. Although Major Crawford doubled temporarily as Department Engineer for four months in 1929 and 1930, the War Department did not assign both jobs to the same officer on a permanent basis again until the Second World War.

Around 1929 the District Engineer's fortification duties shrank even further with the temporary assignment of fortification maintenance to the Department Engineer. By 1932 this task apparently had reverted back to the District Engineer. Fortification construction remained under the Honolulu Engineer District during the entire period and included the completion of the concrete Engineer wharf at Honolulu in 1922 as well as the construction of a 16-inch gun battery at Fort Weaver in the Ewa region of Oahu around 1930. At least until 1926 the District continued to build more roads on the island, as land defenses, and later laid an underground cable almost all the way around Oahu, as a fire control project. Also under the District Engineer's continued charge was the Engineer Depot, which now

included a supply depot in Honolulu and a storage depot at Schofield Barracks. Few new fortification projects began in this decade, and especially after 1926, when the District Engineer no longer served as Department Engineer, defense activities fell in relative importance to civil works.

Even in the area of navigation projects, the Honolulu District experienced a lull during the first half of the decade. Congress made no appropriations for Hawaii's harbors in 1920, 1921, or 1922, for example, while the $375,000 allotted to the Hilo Harbor project in 1923 was the only appropriation for new navigation work on the Big Island between 1919 and 1926. Most of the construction of Nawiliwili Harbor awaited both local cooperation and an initial Congressional appropriation after 1925. Because of this reduced funding, the District's civil works activities from 1920 to 1925 focused on maintenance projects such as surveys at Kahului and Hilo and the emergency removal of a shoal in Honolulu Harbor. Some new work also continued during these years at Honolulu and Nawiliwili.

Civil works activity increased markedly around 1925, then, as the result of several factors. Once again the history of the Honolulu Engineer District followed the history of the world: when the Washington Naval Treaty of 1922 prohibited the U.S. from further fortifying the Philippines, Guam, or Wake but allowed her to continue in Hawaii, the Federal Government sought to build up the Territory's defenses by means of river and harbor improvements as well as by construction of fortifications. A mock "invasion" of Hawaii's waters in May of 1925 also called attention to the need for larger harbors lest small ports be blocked by enemy ships. Another incentive for renewed harbor appropriations at this time arose after the House Committee on Rivers and Harbors learned from Territorial representatives in 1924 that Hawaii's harbor projects could all be completed at the unexpectedly low cost of $4 million. Further impressing Congress was the extent of local cooperation carried out in connection with previously authorized projects. At Honolulu, for example, three pineapple companies announced in 1924 that they planned to dredge a 100-foot wide strip along the northern edge of the Reserved Channel adjacent to the Federally dredged project. The Territory meanwhile had constructed seawalls, buoys, wharves, and dredging slips at Honolulu and similar facilities at Kahului and Hilo.

Thus locally constructed improvements combined with America's defense posture in the 1920's to convince Congress to increase its authorizations and appropriations for Hawaii's harbors. The River and Harbor Act of 3 March 1925 called for another preliminary examination and survey of Honolulu Harbor, Kalihi Harbor, and connecting channels, and also authorized the further extension of the breakwater and dredging in the bay at Hilo. The Nawiliwili Harbor project received its first appropriation of $296,000 in fiscal year 1926 and the next year was allotted an additional $180,000. At Kahului, the October 1925 report of the District Engineer resulted in the authorization by the River and Harbor Act of 21 January 1927 of an extension of both breakwaters and the enlargement of the dredged basin. Further activity after 1925 included a 120-page report on **Ports of the Territory of Hawaii** prepared under the supervision of District Engineers Johnson and Lanagan for the Board of Rivers and Harbors. The booklet was submitted in January 1926 as an aid to both the War Department and the U.S. Shipping Board. Still a slow period when compared to the previous ten years or to the 1930's, the late 1920's nevertheless saw a slight increase in civil works activity and in particular witnessed the completion by the end of 1931 of major portions of the four Federal harbors in Hawaii.

At Honolulu, work picked up around 1925 on the Reserved Channel portion of the existing project. Ninety-four per cent completed in June 1925, the entire project was finished during the next fiscal year at a total expenditure thus far of $2,658,382. The entrance channel had been dredged to a depth of 35 feet and a minimum width of 400 feet; the harbor width now ranged from 1,200 feet to 1,400 feet with a depth of 35 feet; and the Reserved Channel was 35 feet deep and 800 feet wide over a length of 1,000 feet.

As the dredging of this section of the Reserved Channel neared completion, the Federal Government considered extending the channel all the way to Kapalama Basin over a total length of over 3,000 feet. Major Lanagan reported in January 1926 that, while the existing entrance channel and harbor basin would be satisfactory "for a number of years to come," if the Engineers extended the Reserved Channel the Territory would build additional terminal facilities at Kapalama Basin. Such facilities, he noted, while not yet necessary, were "highly desirable" as they would create a new industrial area near Kapalama. In addition, in dredging a 100-foot wide, 20-foot deep, and 2,800-foot long canal between the Federally dredged channel and Kapalama Basin, private parties had also blasted below the 20-foot depth so that now the canal could be deepened easily by the Federal Government.

Major North agreed with Major Lanagan's suggestion that the project provide for an eventual width of 800 feet over the full length of the extended Reserved Channel but that at this time the District dredge the new section of the channel to a width of only 300 feet. The additional 100-foot strip already excavated by private interests would result in a Reserved Channel measuring 800 feet wide over a length of 1,000 feet and 400 feet wide up to Kapalama Basin. The Division Engineer did not recommend a final width of 800 feet but did approve of the plans for a 400-foot wide channel over the full length. Thus the modified Federal project, as authorized by the River and Harbor Act of 3 July 1930, provided for a channel 3,000 feet long, 300 feet wide, and 35 feet deep along

the northerly side of the Reserved Channel, where local interests had already dredged their 100-foot wide strip. Bids opened in December 1930, and this portion of the project was completed in September 1932. Once again Honolulu exhibited the step-by-step development typical of most of Hawaii's harbors: just as the first Reserved Channel modification had been authorized while the original project was still under construction, so this extension of the Reserved Channel was considered before the first portion of the channel had been completed. The next few decades of the District's history would see Honolulu Harbor's continued growth to the west.

Hilo Harbor also experienced further development in the 1920's. After local interests urged the enlargement of the Big Island's harbor so that transpacific vessels might stop there as well as at Honolulu, in January 1924 Major Lanagan proposed the extension of the breakwater to the originally authorized length of 10,170 feet and the dredging of three areas within the harbor basin to a depth of 35 feet. This project modification was authorized by the River and Harbor Act of 3 March 1925, the same bill which had called for a new survey of Honolulu Harbor. In May of 1925 the Hilo Chamber of Commerce impressed a visiting Congressional party with the importance of the Hilo Harbor breakwater, and work by contract and by Government dredge progressed quickly in the next few years. The project was completed in July 1930, at a total cost thus far of approximately $3.4 million.

The second half of the decade saw a similar modification at Kahului Harbor both authorized and constructed. The project as completed in 1919 had provided for two breakwaters, each approximately 2,000 feet in length, and a harbor basin 900 feet in width. Authorized by the River and Harbor Act of 21 January 1927, the new modification would extend the east breakwater to 2,850 feet and the west barrier to 2,396 feet and would enlarge the harbor basin to a maximum width of 1,450 feet. Work on this project accelerated after 1929 and construction was completed in December of 1931. The original Kahului Harbor project had been authorized and completed within a four year period; then the west breakwater had been adopted and constructed within five more years; now the extension of both breakwaters was authorized as a project modification in January 1927 and was completed five years after that. Whereas continuous modifications during construction marked the development of Hawaii's other harbors, at Kahului once again the existing project was completed before further modifications were adopted. This harbor project differed from those at Hilo and Honolulu because of its cost, too: by 10 August 1932 the Federal Government had spent $3.4 million at Hilo, $2.9 million at Honolulu, and only $1.7 million at Kahului.

Maintenance costs would eventually near expenditures for new work at Kahului, however, since the harbor continued to suffer from both shoaling and storm damage. By 1927 gradual shoaling had re-

Aerial view of Honolulu Harbor in 1925, looking south. The Reserved Channel divides Sand Island from the Honolulu waterfront lying in the foreground; Quarantine Island is the foliage-covered area immediately to the south of Sand Island.

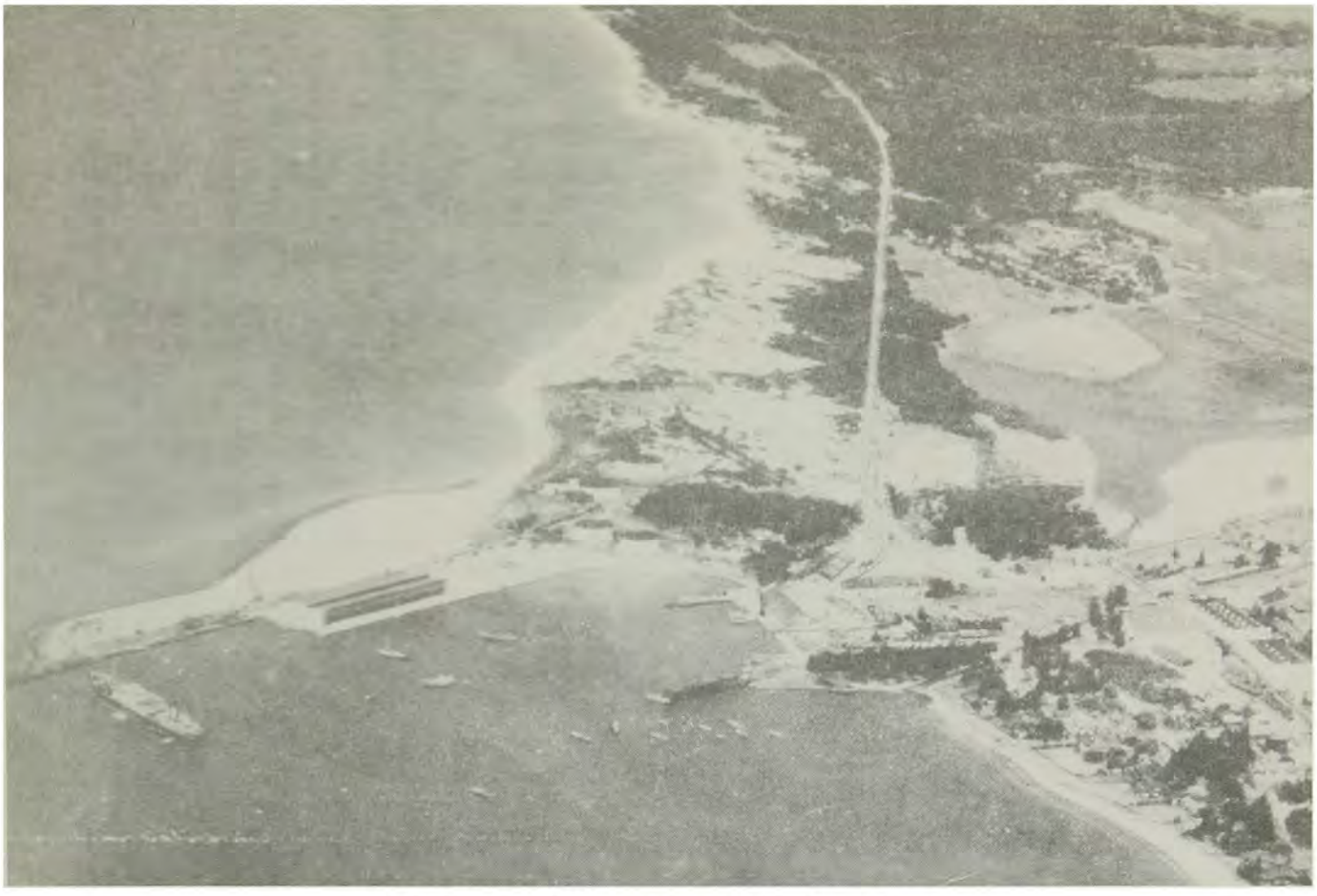
Aerial view of Honolulu Harbor in 1929, looking north. Sand Island lies in the left center of the photo; the Aloha Tower marks the waterfront on the right.

duced the minimum depth in the harbor basin to 33 feet, while repairs to the end of the east breakwater had been necessary in 1924. The District Engineer's Annual Report for 1930 noted that recent additional damage to 296 feet of the east breakwater was then being repaired. Major Crawford predicted many more years of continued restoration of the outer ends of both breakwaters and annual maintenance dredging in the harbor basin.

Meanwhile, construction proceeded on the breakwater segment of the Nawiliwili Harbor project which had been authorized in 1919. By July 1921 the Territory apparently had complied with all conditions of local cooperation, and in October of that year dedication ceremonies marked the laying of the breakwater capstone. The first half of 1924 saw a total of 1,454 feet of the breakwater placed and the old Nawiliwili-Hanapepe debate resumed.

With one half of the Nawiliwili breakwater completed and protection afforded to small vessels, dredging could now begin. The Kauai Chamber of Commerce eagerly sought the appropriation of the promised funds from the Territorial Legislature so that dredging could proceed and the local government could utilize the anticipated fill as a site for its proposed wharves. Until wharves were built at Nawiliwili, ships would continue to go to the nearby port of Ahukini or to lighter at Nawiliwili. Before the Territorial Board of Harbor Commissioners would recommend those funds, however, it insisted on guarantees from Kauai's sugar companies that they would indeed ship through Nawiliwili. The Board's stand was interpreted as an indirect criticism of the Engineers' site selection, for several sugar companies, whose fields were located west of Hanapepe, had already announced their preference for Port Allen and their refusal to use Nawiliwili even if that harbor were developed. At the urging of the outraged Chamber of Commerce, then, Major Lanagan called a public hearing in September 1924 and acknowledged at that time that the Board's continued refusal to approve the Territorial contribution would force him to recommend the suspension of Federal work at Nawiliwili. Alarmed by this threat and pressured by the Chamber, the Board agreed to survey the harbor; further persuaded by the opinion of a neutral civilian expert hired by the Chamber, the Legislature in 1925 finally appropriated the $200,000.

As the Engineers finished the breakwater in March 1926, then, the Territory took over the Federal camp and equipment and began construction of a concrete wharf. As soon as the Government dredge **A. Mackenzie** finished at Hilo she began work at Nawiliwili in fiscal year 1929, and dredging was completed in July 1930. The official opening of the $1.3 million harbor on 12 July inaugurated an entrance channel 600 feet wide, 2,400 feet long, and 35 feet deep; a harbor basin 1,100 feet wide, 2,000 feet long, and 35 feet deep; and a rubblemound break-



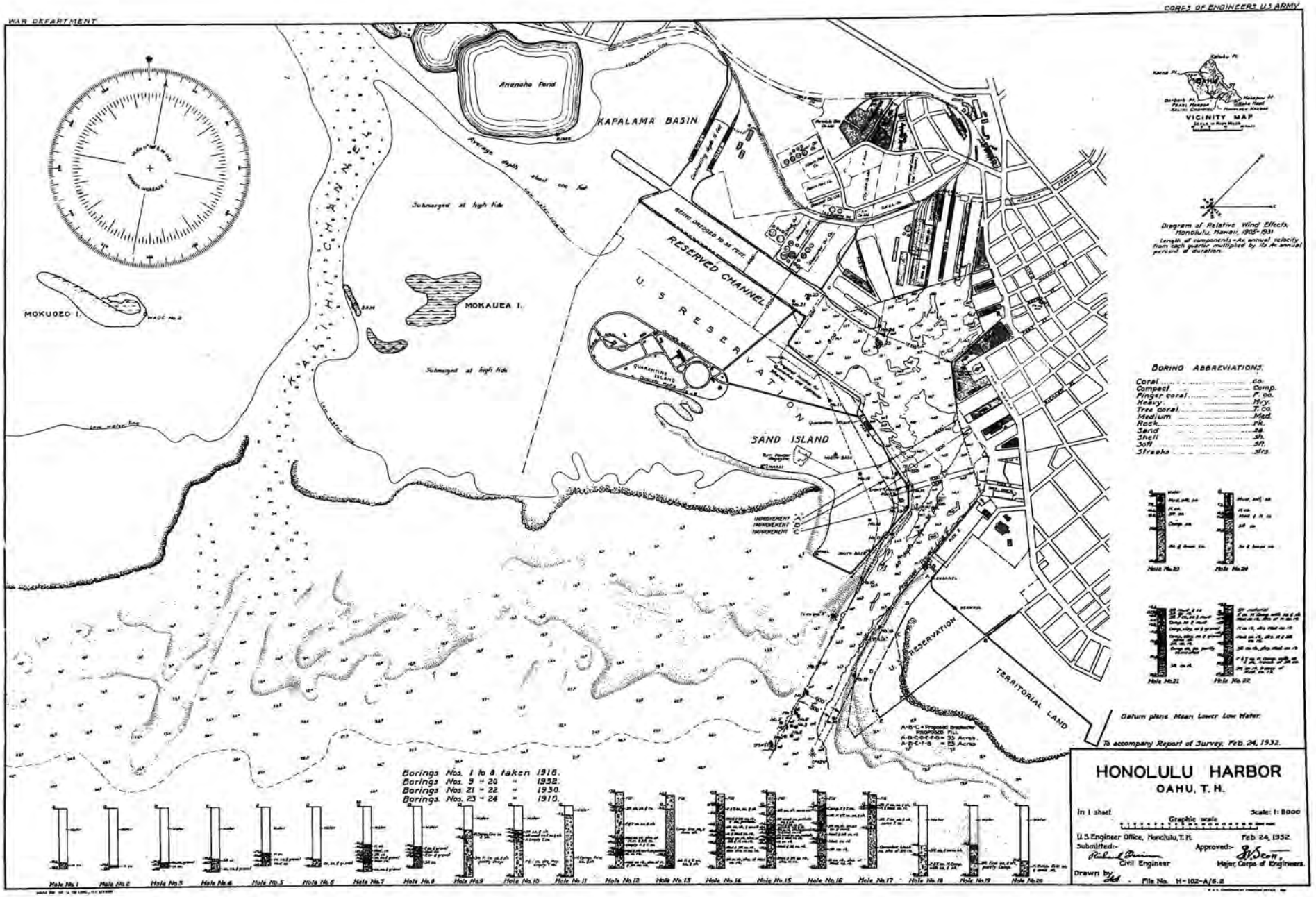
Aerial view of Kahului Harbor, Maui, in 1925, looking northwest.

water 2,150 feet long. Although the project was completed by the end of the decade, however, many Kauai shippers remained reluctant to use Nawiliwili Harbor. Their preference for Hanapepe (Port Allen) had delayed the original selection of the harbor site earlier and had postponed the actual dredging of the basin now. Nor did the debate end with the harbor's completion: the Annual Report for 1931 noted that the railroad connections assured as a condition of local cooperation had not yet been finished. Even into the 1930's, many local interests on Kauai seemed to prefer Port Allen to Nawiliwili.

By the end of 1931 the Honolulu Engineer District had constructed deep-draft harbors at Honolulu, Hilo, Kahului, and Nawiliwili, and at all but Honolulu the existing projects were finished for the time being. The 1920's represented a quiet period for the District: fortification work diminished while civil works projects neared completion. This decade would prove to be a lull before a storm of activity in Hawaii, for just as economic conditions and national defense needs were partly responsible for the slight slowdown of the 1920's, so these factors resulted in a quickened pace and a greater variety of tasks in the 1930's.

Footnotes — Chapter III

1. **Paradise of the Pacific**, March 1924, p. 17.
2. **The Honolulu Advertiser**, 16 February 1926, p. 1, col. 4.



Map of Honolulu Harbor in 1932.

CHAPTER IV: Exploring New Paths

At the start of the 1930's few people in town knew much about the U.S. Engineers. The Honolulu District's principal defense duties involved the construction of a few new gun batteries and the operation of the Engineer Depot, while civil works activities focused on the completion of the islands' four main harbors. By 1939, however, the District had added to its earlier responsibilities three small harbor projects, an important dredging job at Midway, and both the Public Works and the Works Progress Administrations. This expanded activity naturally brought the District into close contact with the people of Hawaii. The vibrant personalities of some of the decade's District Engineers called further attention to these new jobs and to the Engineer Department itself, so that by the end of this era Hawaii was very much aware of the U.S. Engineers.

The 1930's also illustrated well the two themes of the District's history: the variety of its work and its adaptability to world and national events. Just as First Lieutenant Slattery had charge of the islands' lighthouses and Major Wooten served also as Department Engineer, so now Major Stanley L. Scott assumed the Public Works Administration in Hawaii in 1933 and Major Peter E. Bermel became Works Progress Administrator in the islands in 1938. The District thus continued to handle a wide variety of chores. To a large degree the assumption of these additional duties resulted from the economic situation of the times, for the Great Depression created a slowdown in the first few years of the decade and then generated new funds and new programs, some of which were assigned to the Honolulu District. Increased international commerce and the growing threat of Japan as a sea and air power also shaped some of the Engineers' activities later in the decade. The era of the 1930's, then, marked the Honolulu District's debut on the stage of Hawaii and pointed out better than any previous period the diversity of work the District performed in response to its changing world.

Few innovations occurred in the organization or activities of the District during the first few years of the decade. While the office remained in the Federal Building until 1938, field offices on the other islands wound up their work on the harbors. Serving as the decade's first District Engineers were Major Robert W. Crawford, who supervised an all-civilian staff and also acted as Department Engineer for four months, and Major Scott, who impressed the local community with his earnestness and his efficiency.

Defense projects in the early 1930's included the completion of gun emplacements in the Ewa district and similar construction at Fort Kamehameha. Secret plans to build an ammunition storage plant near Aliamanu Crater were revealed by the **Honolulu Star-Bulletin** as early as 1929.[1] The District constructed macadamized roads, underground storage magazines, and miscellaneous structures at Aliamanu in 1931 and 1932 and apparently finished the project around 1936. Later in the decade, 1937 and 1938 saw the District engaged in the Construction of a chemical storage project at Schofield Barracks.

Navigation projects progressed almost as slowly as military work between 1931 and 1933, for most of Hawaii's major harbors had been completed by then, and the early years of the Depression restricted additional Federal spending. The Government dredges **A. Mackenzie** and **San Pablo** performed maintenance dredging at Honolulu, Hilo, Nawiliwili, and Kahului; minor repairs were made to the breakwater at Nawiliwili in fiscal year 1935. Only Honolulu saw new work in the early 1930's, as Government dredges completed the recently authorized channel in September 1932. The late 1920's and the early 1930's marked the shift in the Honolulu District's civil works projects from the exclusive employment of contract dredges to the use of Government plant as well.

Members of the Honolulu District staff spent much of their time in this period on navigation surveys and reports. In 1933 an assistant civil engineer, Charles B. Jones, designed an 18-foot sounding boat for use in hydrographic surveys and developed a timesaving system for locating and plotting soundings. Another type of investigation resulted in Major Scott's report in 1934 on shipping statistics in the Hawaiian Islands; his study showed that between 1924 and 1933 commerce had distributed itself among the new outer-island ports while the percentage of interisland traffic passing through Honolulu had declined.

As the four deep-draft harbor projects neared completion, the River and Harbor Act of 3 July 1930 called for investigations of approximately a dozen

sites in the Hawaiian Islands for possible future harbor development. In December 1931 and February 1932 the District Engineer reported unfavorably on Lahaina and Hana, Maui, where benefits would accrue principally to private interests; on Kamalapau, Lanai, where private facilities were adequate; and on Hilo, Hawaii, where the existing project already provided for commercial needs. Major Scott favored construction of a breakwater and a wedge-shaped harbor at Honuapo, one of several areas surveyed on the coast of the island of Hawaii, but an unfavorable recommendation was submitted by the Chief of Engineers in May 1933 on Honuapo, Kailua, Kawaa, and Punaluu on the Big Island.

Local interests seemed satisfied with the District Engineer's decisions on these outer-island sites but were disappointed that he did not recommend dredging Kalihi Channel to provide a second entrance to Honolulu and Pearl Harbors. Major Crawford explained in his report of July 1931 that if Honolulu Harbor were blocked the Navy could clear the channel and would meanwhile arrange for commercial use of Pearl Harbor. The Division Engineer agreed that the second entrance was not needed, and an unfavorable report on Kalihi Harbor and Keehi Lagoon was submitted to Congress in June 1933. The 1930's thus saw further consideration — but not yet authorization — of the second entrance channel to Honolulu Harbor.

Of the dozen or so sites surveyed in these years, three were selected by the District Engineer for future harbor improvements: Honolulu, Kaunakakai, and Port Allen. In December 1932 Major Scott incorporated in his recommendations for Honolulu the Territorial Harbor Board's suggestion, made four years earlier, that the harbor be widened by cutting off the eastern shoulder of Sand Island. His report proposed widening the entrance channel from 400 feet to 600 feet; deepening the entrance channel from 35 feet to 40 feet; widening the basin by removing 320 feet from Sand Island; and maintaining the Reserved Channel over a width of 400 feet. The Board of Engineers recommended an entrance width of only 500 feet but otherwise approved Major Scott's suggestions.

The Hawaiian Homes Act of 1921 was meanwhile transforming Molokai from an unproductive wasteland to an agricultural island populated by native Hawaiians. The development of this fifth island in the Hawaiian chain called for harbor improvements at Kaunakakai, one of the sites surveyed under the River and Harbor Act of 3 July 1930. The proposed project aimed only at the elimination of lightering and a consequent decrease in freight costs and did not intend to create a deep-draft transpacific harbor. Thus Major Crawford's report of September 1931 recommended neither a breakwater nor deep dredging, but the construction of an interlocking sheet pile retaining wall extending shoreward 350 feet and a harbor basin 1,500 feet long, 800 feet wide, and 23 feet deep. The Chief of Engineers eliminated the retaining wall and decreased the project width to 600 feet in his 1933 report to Congress.

Also on the list of sites to be examined by the District Engineer under the River and Harbor Act of 3 July 1930 was Port Allen. In investigating harbor facilities on Kauai, Major Crawford determined that many plantation owners were shipping through the small harbor at Port Allen rather than via the Federally developed harbor at Nawiliwili. Local interests had not completed the railroad connections near Nawiliwili and now claimed that shipping overland through the Federal harbor cost more than sending sugar out of nearby Port Allen. Accepting the reality of the situation, then, in July 1931 Major Crawford recommended a Federal harbor project at Port Allen. As submitted by the Chief of Engineers in 1933, the project provided for construction of a rubblemound breakwater approximately 1,200 feet long on the east side of the bay; a harbor basin approximately 1,000 feet wide, 1,500 feet long, and 35 feet deep; and an entrance channel 500 feet wide and 35 feet deep. Required in 1919 to contribute cash towards the construction of Nawiliwili Harbor, local interests were once again to furnish $200,000 in addition to the usual rights of way. Major Scott had attempted to justify the improvement of a second harbor on Kauai by arguing that with construction of the proposed project at Honuapo, the Big Island would have two Federal harbors; so, he reasoned, might Kauai. As noted above, however, the harbor at Honuapo was not approved. Thus Kauai, smallest of Hawaii's four major islands, became the first in the chain to see two of its harbors improved by the Federal Government.

Over twenty years of continued pressure by local interests on Kauai finally resulted in approval of a federal harbor project at Port Allen, then, while the development of Molokai called for improvements at Kaunakakai and increased traffic through Oahu led to the recommended enlargement of Honolulu Harbor in the early 1930's. The scarcity of regular funds in those years might have kept the three projects on the inactive list until after the Depression. The very economic situation which had restricted civil works spending from 1930 to 1933, however, then inspired several acts designed to provide employment and otherwise stimulate the national economy. Among the civil works projects funded by the National Industrial Recovery Act (NIRA) and authorized by the Public Works Administration in September 1933 were these at Honolulu, Kaunakakai, and Port Allen. All three projects were later adopted by the River and Harbor Act of 30 August 1935.

The District spent $784,000 of the $792,000 allotted by the NIRA to enlarge Honolulu Harbor in 1934 and 1935. Under the direction of Mr. Jones, as Project Engineer, the entrance channel was dredged to 40 feet and widened to 500 feet, 320 feet of Sand Island were removed, and the cutoff shore of Sand Island was revetted. In an interesting flashback to an ear-

lier chapter in the District's history, on 10 May 1934 Major Scott turned over to the Lighthouse Service new quarters on Sand Island and took possession of the original lighthouse building on the corner of the island for demolition purposes. The harbor light commissioned by Major Winslow in 1910 was removed by Major Scott in 1934 for the enlargement of Honolulu Harbor.

Savings were also effected at Kaunakakai, where $103,000 of the $120,000 allotted by the NIRA was spent. Between December 1933 and January 1934 the District dredged a harbor basin 1,500 feet long, 600 feet wide, and 23 feet deep to accommodate inter-island tugs and barges. At Port Allen, work began on the breakwater in December 1933 and was completed in June 1935, while the Government dredges **P.S. Michie** and **A. Mackenzie** dredged the harbor basin to 35 feet deep during 1935. Total expenditures included $680,000 from the NIRA, $200,000 as a local cash contribution, and $4,528 from regular funds. Although these projects at Honolulu, Kaunakakai, and Port Allen were small in both size and cost compared to previous and later harbor developments in Hawaii, their construction between 1933 and 1935 signaled the end of the Honolulu District's Depression-generated lull and the start of new endeavors.

Among those new endeavors was the administra-

Port Allen Harbor, Kauai, approximately thirty years after Federal construction.

tion of the Public Works program in Hawaii, for the expenditure of NIRA allotments for island harbors was not the only recovery era project entrusted to the Honolulu District. As a result of his appointment in August 1933 as representative of the Public Works Administration (PWA) for the Territory, Major Scott expanded his office and brought the Honolulu Engineer District into the public eye. For example, although the summer 1931 telephone book listed only the District Engineer, by February 1934 the directory had added separate listings of the various District branches, including PWA. Three telephones were recorded in 1933, five in 1934, and eight in 1935. An article in the **Honolulu Advertiser** in April 1934 applauded Major Scott's "four keymen," Captain Patrick H. Tansey, Lieutenant T. M. Osborne, Mr. V. K. Grouillard, and Mr. O. E. Frowe, for their efficiency in administering the public works programs in the islands.[2] The public thus came to know the names of not only the District Engineer but his assistants as well. Major Scott spoke twice to the Engineering Association of Hawaii, once on Honolulu's harbor development and again on waterborne traffic in the Hawaiian Islands. Within the office, too, Major Scott was respected and well liked. As part of the District Engineer's active safety program, administered by Captain Tansey, **Safety News Letter** was published monthly, "Safety Help" was enclosed with each pay check, and monthly meetings were held with foremen and inspectors. As a result, in a nationwide Engineer Department safety contest held in 1935, the Honolulu District tied for first place. The July 1934 issue of **Safety News Letter** regretted the departure of "an inspiring leader and a true engineer." "It is an honor to say," the editor declared, "I am in Major Scott's office!"

Major Scott and his successor, Major R. G. Barrows, administered PWA projects in the Territory. From fall 1933 through February 1934 the District office accepted applications for aid from various public bodies, which could receive 30 per cent of the cost of labor and materials on those projects approved by the PWA. In addition, the local agencies were eligible for loans at 4 per cent interest to be paid over a 30 year period if they were unable to finance the remaining 70 per cent of the project cost.

The PWA in Washington approved 10 of the Territory's 13 applications and obligated 30 per cent of the total $2,870,000 required to complete the ten projects. The PWA also loaned $440,000 to local agencies at 4 per cent interest. This aid was in addition to funds already allotted for construction of the three harbors and for seacoast defenses, labeled as "Federal" PWA projects. Among the "non-Federal" or purely local enterprises were the expansions of water supply systems on Oahu, Molokai, Kauai, and Hawaii. The City and County of Honolulu also submitted a large program which included the construction of additions to Roosevelt and Thomas Jefferson schools, bridges on Kuakini Street, and an extension of Kapiolani Boulevard. Housing projects

Major S. L. Scott, Honolulu District Engineer, 1931-1934.

were apparently added as part of the PWA program while Major Barrows was District Engineer. Majors Scott and Barrows frequently had to admonish local public bodies to accelerate their plans, for in order to receive the full amount of Federal funds the first set of projects had to be completed by July 1935. In March 1934 Major Scott urged Mayor G. Fred Wright to speed up work on Oahu's PWA projects; the District Engineer was especially disturbed that the Roosevelt High School auditorium was 79 days behind schedule. Although other public works activities such as the Works Progress Administration later overshadowed some of these jobs, the District Engineer continued to administer PWA projects in Hawaii until April 1939.

This supervision of public works programs in Hawaii not only introduced the Honolulu Engineer District to the local population but also aided the Territory's economic recovery. PWA provided indirect relief: local contractors, not the Federal Government, offered jobs and benefited from the Federally supported programs. In fixing minimum wages on its own projects, PWA influenced salaries in other industries as well and thereby raised the Territory's

standard of living. Because of these benefits and because of Major Scott's efficiency and calm, the District remained on good terms with the people of Hawaii. In acting as Public Works Administrator for Hawaii the District Engineer once again wore two hats, for in his PWA duties he reported to Secretary of the Interior Harold Ickes. The local road and school construction projects administered in the 1930's attested to the continued variety of work carried out by the Honolulu District and heralded similar projects constructed by the Engineers during World War II. The addition of PWA tasks at this time also reflected the Honolulu District's response to the nation's economic conditions in the mid-1930's.

Major Barrows' relief, Lieutenant Colonel Roscoe C. Crawford, continued to act as Public Works Administrator, as did his successor, Captain L. T. Ross. When Major Peter E. Bermel became District Engineer in November 1937 he continued to administer PWA works in Hawaii, although most of the projects were already completed and the national program soon ended, in April 1939. In fact, by the time Major Bermel arrived in Honolulu, the District's eyes were already focusing on new horizons, as plans began for a project at Welles Harbor on Midway Island.

The navigation project at Midway formed an interesting and important part of the Honolulu District's history for several reasons. Welles Harbor, unlike the natural harbors of the Hawaiian Islands, consisted of a lagoon surrounded by a circular coral reef through which the Engineers were to dredge a new entrance channel. Instead of improving an already existing harbor such as those at Honolulu or Hilo, that is, the Engineers were to create a new entrance to the lagoon harbors by dredging through a hard coral reef. Exhibiting its flexibility once again, the District constructed "marine bombs" charged with dynamite by means of a driving chuck to blast coral formations in rough waters where the usual drill rig might be unsafe. Secondly, the project at Midway and a similar job planned for Wake Island represented the start of the Honolulu District's geographic expansion. Whereas up to 1935 the District's jurisdiction extended to "all islands in the Hawaiian group," in the 1936 Annual Report this was clarified to read, "all islands in the Hawaiian group, including Midway Island and Wake Island." In World War II the District's scope would range as far as New Caledonia and in the 1960's its activities would include work in the Marshall Islands. The thousand-mile leap to Midway in 1936 thus marked only the beginning of the District's expansion to the Western Pacific, just as the PWA activities of the same period marked only the start of the District's involvement with the people of Hawaii.

In the justification for dredging Welles Harbor at this time lay another significant feature of the District's history. Chapter I noted that in his report of 22 August 1905 First Lieutenant Slattery decided the needs of commerce did not warrant the improvement of Welles Harbor at that time. Had the needs of commerce increased by 1936, then? Indeed they had — but it was the airborne commerce of the 1930's rather than the sea traffic considered by First Lieutenant Slattery that led to the project at Midway. In the early 1930's Pan American Airways had begun using the lagoon at Midway for the landing and taking off of her seaplane clippers. The rough seas in the harbor made passenger transfer from plane to launch quite dangerous, however, and also created difficulties in fueling and servicing planes moored in the lagoon. Similar complaints came from the Commercial Pacific Cable Company, whose supply ships had to anchor outside the inner harbor. These interests requested that the Engineers dredge a channel through the reef into the inner harbor, and Pan Am also asked the U.S. Government to construct a protected basin for use as a seaplane harbor.

Although these commercial demands alone might not have resulted in authorization of a Federal project at Midway, they were accompanied by convincing reasons of defense. The U.S. had agreed in 1922 not to fortify any Pacific islands except Hawaii; this promise had influenced the further development of several Hawaiian harbors around 1925. Now, on 29 December 1934, Japan gave formal notice that two years later she would no longer observe the terms of the 1922 Washington Naval Treaty. Japan's decision aroused America's fears and at the same time freed the U.S. from her previous defense limitations. So freed, America looked to Midway and Wake Islands as new outposts of her fortification frontier. The U.S. Navy, which controlled Midway Island and would operate the new harbor after its completion, seconded the commercial companies' requests for a new entrance channel so that naval warships could use the harbor as a refueling base. The needs of commerce and the needs of defense thus combined to justify the harbor project at Midway Island, and the Honolulu District's history was once more linked with that of the world — this time with the development of clipper travel and the growing threat of Japan in the 1930's. The project at Welles Harbor introduced the Honolulu Engineers to an unusual type of dredging and to a new area of the Pacific and continued the District's tradition of adaptability to current events.

Plans for Welles Harbor were considered as early as 1935, then, and in May 1936 Major Barrows recommended an entrance channel, a turning and anchorage basin in the inner harbor, and a seaplane harbor as well. The River and Harbor Act of 26 August 1937 authorized an entrance channel from deep water in the Pacific through the southerly reef to deep water in the lagoon with widths in the channel decreasing from 500 feet at the seaward end to 200 feet in a distance of 1,000 feet, continuing at a width of 200 feet for 5,500 feet more. The entrance channel would end in a harbor basin approximately 1,200 feet square; the project depths would be 22 feet in the outer 1,500 feet of the entrance channel and 20

feet in the remainder of the channel and the basin. Thus the old entrance to the inner harbor through Seward Roads and the outer harbor was abandoned, and a new channel was designed.

The District Engineer had also recommended the dredging of a seaplane harbor at Midway, but both the Division Engineer and the Board of Engineers for Rivers and Harbors vetoed this improvement on the grounds that only Pan American, and not the U.S. Navy, had requested such a basin. Local interests, the Division Engineer and the Board argued, rather than the U.S. Government, should dredge the seaplane harbor. This basin did become part of the project for Welles Harbor, however, when it was authorized separately by a Rivers and Harbors Committee resolution passed in the 75th Congress, 1st session. The seaplane harbor basin would be 1,200 feet square and 8 feet deep, would be protected by suitable breakwaters, and would include a flared entrance channel also 8 feet deep. In 1937 the total estimated cost of new work for Welles Harbor was $1,041,000.

Among the preliminary tasks performed at Midway were hydrographic and topographic surveys in the spring of 1936 and mobilization in preparation for dredging and breakwater construction in fiscal year 1938. In July 1938 Major Bermel attended a conference on the Midway project at the Division Engineer's office in San Francisco. Earlier that year the District Engineer publicized one hundred new jobs for U.S. citizens experienced in drilling, blasting, and dredging. A six-month contract, he announced, would reap a free boat ride from Honolulu to Midway and wages equal to those given on the mainland.

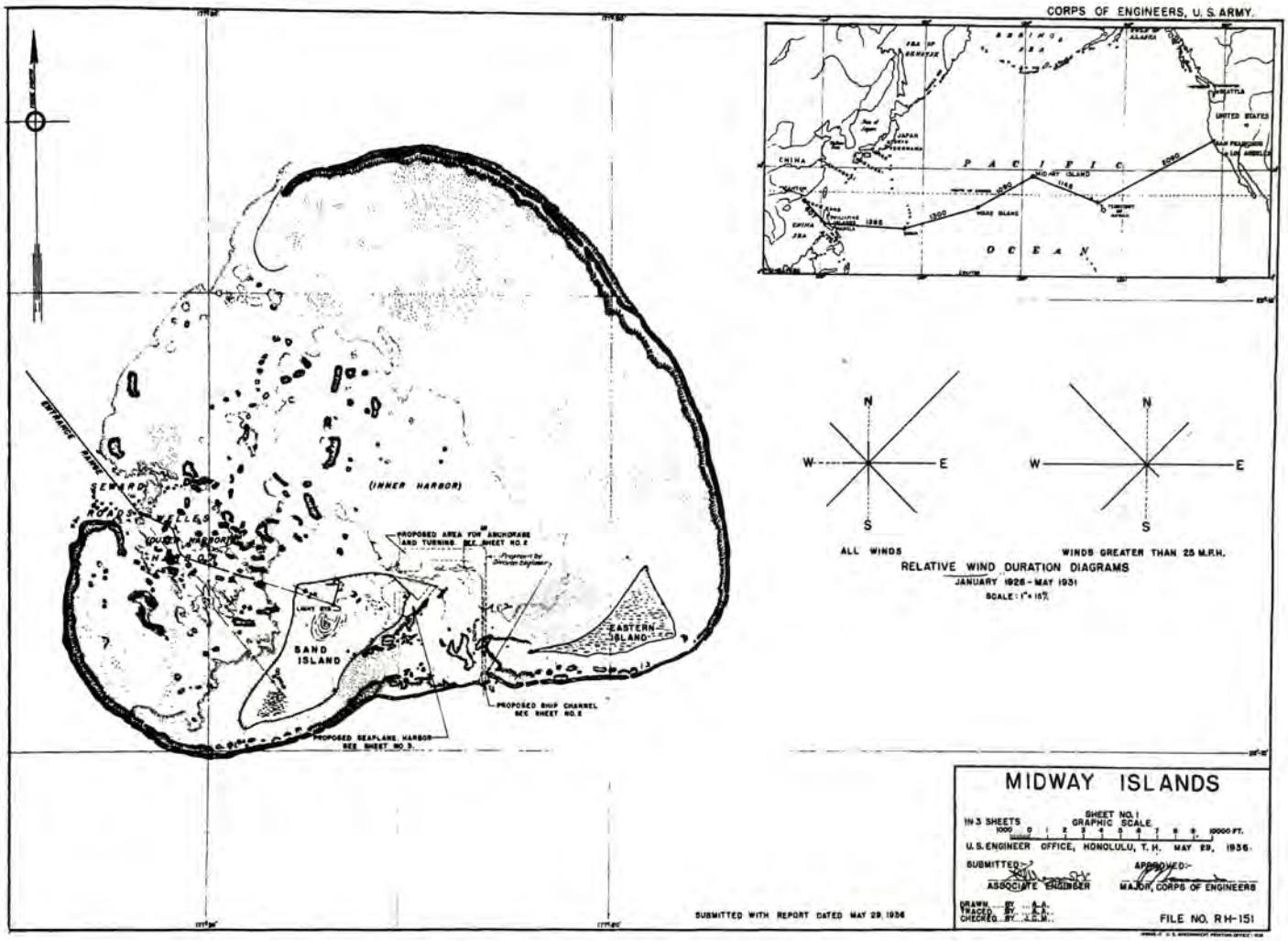
The work at Welles Harbor soon commanded some of the Corps' top talent and the District's enthusiastic interest. First to arrive from the Honolulu District was a storekeeper, who landed at Midway in August 1938. Major Bermel flew to Welles in late summer 1939 with civil engineer F. C. Scheffauer from the San Francisco office; Walter N. Davis and Jack N. Schlessinger, consultants from OCE; and Captain Randolph Petterson, formerly in charge of drilling operations for the Golden Gate Bridge. Principal civilian assistant was Mr. Jones, whose experience in dredging Honolulu Harbor was considered excellent background for his supervision of the dredging and blasting operations at Midway.

First Lieutenant William J. Ely, a 1933 graduate of West Point, proved very popular as the first officer in charge of the project at Midway. He was relieved in late 1939 by Mr. William H. Wheeler, a former Captain in the Corps of Engineers. In November 1939 the staff at Midway sent its chief clerk to Honolulu to request additional clerical help, and in February 1940, at the peak of the harbor's construction, 120 new employees left Honolulu for Midway. The men at Midway maintained a gay camaraderie as they waited out the 30 mail-less days between clipper arrivals at "the lonely isle." A procurement staff member described the U.S. Engineer Department camp at Midway for the folks back home: "Our little town appears similar to the mining towns one sees in the movies of the days of '49," he wrote, "and there's a fine spirit prevalent of general goodfellowship. Work seems to be considered in a serious manner but there is also playtime."[3] The Honolulu District's representatives at the Welles Harbor project tempered their disappointment at the isolated assignment with a cheerful esprit de corps.

Important plant aided the staff at Midway. In the spring of 1938 the U.S. tug **Beverly** was transferred from Philadelphia to the Honolulu District for service at Midway; in late 1939 a used towboat, the **Monterey**, was purchased for use on the project and an additional towboat, the **Mathilda Foss**, was rented from a Pacific coast firm. The clamshell dredge **Holland** and the derrick barge **Haviside No. 5** joined the towboats in December 1939 and early 1940, when four drilling platforms were also moved to Midway for the Welles Harbor dredging. Two others at work on the project were the U.S. Navy dipper dredge **Hell Gate** and the U.S. Government clamshell dredge **No. 1**.

The eyes of the District's Honolulu office were on Midway from the start of the dredging in October 1938. During the next year the **Hell Gate** dredged in the entrance channel and the turning basin, while clamshell dredge **No. 1** worked in the seaplane basin. By 30 June 1939 these projects were both approximately 40 per cent completed and 55 per cent of the breakwater on the north side of the seaplane basin had been built. Spirits soared when on 23 October 1939 a Pan Am clipper landed within the seaplane basin being constructed in the lee of the protective breakwater. The landing in the seaplane basin had not been planned, but when strong winds made the lagoon too choppy for landing, the clipper en route from Wake crossed the reef, landed in the basin, and used her lowered tail as a brake to stop within five lengths of her hull. The incident evidenced the rapid progress being made on the project. A wild celebration then followed when the **Hell Gate** broke through the south reef a week or two later. Her skipper, Captain Walter C. Ellis, threw a luau at which First Lieutenant Ely was hoisted proudly to the shoulders of his staff. Major Bermel's congratulatory telegram was read and Hawaiian music was played at the joyous party held to celebrate the "comin' through the reef."

Work continued into 1940 as the pipeline dredge **Sacramento**, rented by the Honolulu District, excavated alongside the **Hell Gate, A. Mackenzie**, and **Holland**. A total of 1,970,730 cubic yards had been dredged by Government plant at a cost of $491,792 by 8 December 1940, when all blasting and dredging operations were completed and only 2 per cent of the breakwater remained to be constructed. The total cost as of 30 June 1941 was almost $2.5 million, or about twice the original estimated cost. In addition, a Navy project authorized in April 1939 provided for enlarging the entrance channel at a



Map of Midway Islands, 1936.

cost of over $1 million, and the Navy was to install the concrete cap on the breakwater. The Corps of Engineers project was considered complete in 1941; maintenance of the project was transferred to the Department of the Navy in 1949. In all respects, the development of Welles Harbor proved one of HED's most successful and significant projects. Dredging through the coral reef provided a new experience for the District, while managing the impressive array of plant with a "chins up" attitude over one thousand miles from home set an excellent precedent for future work on other Pacific islands. Quick and cheerful construction characterized the entire project.

Although Welles Harbor overshadowed all other civil works activities of those years, the District did complete several interesting plans and reports at the end of the 1930's. The same River and Harbor Act of 26 August 1937 which authorized the entrance channel and turning basin at Midway also authorized a similar project at Wake Island Harbor, a thousand miles to the west of Midway. As at Welles, here, too, Pan American's commercial demands and the Navy's defense requirements led to Congressional adoption of the project, which provided for an entrance channel 18 feet deep and 200 feet wide from deep water in the Pacific to a turning basin also 18 feet deep and 1,000 feet square. Estimated to cost $1 million, the harbor would aid in reliable transpacific air service, would provide refuge for small craft, would benefit commercial interests, and would contribute toward national defense.

Captain Ross and Major Bermel continued the District's plans for Wake Island Harbor; according to the **Honolulu Advertiser**, First Lieutenant Ely would be in charge once actual operations began.[4] At this point, however, the events of world history influenced the activities of the District once again. The completion of dredging at Midway in December 1940 was followed immediately by the transfer of Army Air Corps construction to the Corps of Engineers, by the Honolulu District's enormous airfield construction program of 1940-1941, and by the general increase in defense work described in Chapter V. With this new emphasis on military construction, any civil works projects not yet begun would naturally be postponed. Furthermore, before any funds were appropriated for Wake, the Japanese captured the island on 23 December 1941 and

held the post until after their surrender in September 1945. A new hydrographic survey was completed in August 1948, but by that time Pan Am's seaplane clippers and the Navy's 1930-vintage warships were both becoming obsolete. The rising cost estimate ($4.67 million in July 1960) helped place the Wake Island Harbor project in the deferred category in fiscal year 1961.

While working on plans for Wake Harbor, the District Engineers of the late 1930's also submitted a number of unfavorable recommendations on potential Hawaiian harbors. The River and Harbor Act of 30 August 1935 had called for reports on Hilo and Port Allen as well as for those on Welles and Wake; the Hawaiian ports were not considered worthy of further development at that time. Similar reports were completed in 1936 and 1937 on Kamalapau, Nawiliwili, and Kaunakakai, whose studies had been required by a Rivers and Harbors Committee resolution of 14 January 1936.

The report submitted on an investigation of Hilo Harbor with a view toward prevention of shoaling by lava flows followed some interesting studies by the Honolulu District. The investigation had been called for by the River and Harbor Act of 26 August 1937, a year and a half after a lava flow on the Big Island had been halted by experimental bombing at its source. Dr. Thomas A. Jaggar, well known volcanologist, first suggested erecting three barriers at slight angles to deflect the lava flow away from Hilo. After the survey was authorized, Major General Edward Markham, Chief of Engineers, personally examined the affected field on Hawaii. At Major Bermel's public hearing in December 1937, Dr. Jaggar warned of further lava flows towards Hilo within the next 20 years and encouraged Federal action.

Local interests at this hearing also urged Major Bermel to consider a longer breakwater at Hilo to reduce swells and surge in the harbor during heavy weather, and within a few months the lava barrier and surge studies were combined in one investigation. In June 1938 the District Engineer revealed plans for construction of an accurately scaled Hilo Harbor model approximately 30 feet by 40 feet to simulate wave action in the harbor and to evaluate methods of reducing the harbor's surge. Built at the Engineer Storehouse at Fort Kamehameha under the direction of Mr. Jones, this prototype heralded the model of Hilo Harbor which would be constructed by the District in 1964 to study tidal wave barriers at the same location. After over a year of research with the surge model, in early 1940 the District Engineer submitted a favorable report on the proposed improvements at Hilo Harbor. According to South Pacific Division Engineer Colonel Warren T. Hannum, however, the construction of lava barriers on Mauna Kea was not economically justified. Although not authorized at the time, the lava barrier project would be restudied in the mid-1960's, when it would again attest to the varied interests and activities of the Honolulu District.

As a result of the harbor project at Midway and the concurrent model studies of Hilo Harbor, Major Bermel became a familiar figure to Hawaii's citizens. Even if these civil works projects had not attracted so much local interest, the District Engineer's role as Works Progress Administrator in the Territory and his colorful personality would have brought him into prominence in Hawaii. Major Bermel arrived in Honolulu in November 1937, just as plans for Midway and consideration of the Hilo lava barriers were commanding much attention in the islands. Like his predecessors since 1933, he also served as Public Works Administrator until the program ended in April 1939. In addition, on 1 April 1938 the District Engineer took charge of the Works Progress Administration (WPA) for the Territory. Major Bermel was granted an extension of his tour in Hawaii and remained in the islands until relieved

Major P. E. Bermel, Honolulu District Engineer, 1937-1940.

by Lieutenant Colonel Theodore Wyman, Jr., in July 1940.

As the District's duties increased, Major Bermel relied heavily on several assistants, including Captain Ross, who had acted as District Engineer for four months before Major Bermel had arrived, and Major Herman H. Pohl, who relieved Captain Ross as Executive Assistant to the District Engineer and as Assistant WPA Administrator. Major Pohl was cited by the staff newspaper in October 1939 because "his keen sense of justice and strong humanitarian propensities have made him much liked and respected." Also very popular with the District's employees was Captain Bernard L. Robinson, who served from 1938 to 1942 as Contracting Officer, Disbursing Officer, and Property Officer. "Genial"

Captain Robinson delighted his secretaries with his easy dictation and charmed the entire staff when he got married during his tour in the District. As Contracting Officer Captain Robinson was directly involved in the December 1940 defense contract discussed in Chapter V. The well-liked officer returned to Honolulu as District Engineer in 1945.

Major B. L. Robinson. Contracting Officer in the HED, at his desk in 1941.

The District staff grew more rapidly during Major Bermel's tour, for the office eventually absorbed most of the Hawaii staff of the WPA. In August 1939 the District's administrative personnel consisted of Major Bermel, Major Pohl, Captain Robinson, two First Lieutenants, one Second Lieutenant, and a civilian administrative assistant. The number of officers alone reflected an era far more active than that led by First Lieutenant Slattery, and even as recently as the start of the 1930's, the District's staff had comprised only civilians. By 1 December 1940 the Honolulu District's employees numbered approximately 480. At Honolulu as well as at Midway, good fellowship characterized the District in the late 1930's: secretaries did the hula at a luau in August 1939 and celebrated Sadie Hawkins Day; columnists for the District's newspaper, **The Trade Wind**, giggled over rumors of office romance; in mid-1939 budding bowlers lined up for the District's first bowling tournament, as Major Bermel officiated as President of the league and Captain Robinson soon became high scorer.

By 1938 the Engineers had grown too big for their quarters in the Federal Building. The assumption of WPA responsibilities on 1 April 1938 probably accelerated the District's move in September of that year to a new building at Pier 2A, near the Engineer Storehouse. Here the office would remain until early 1941, when further increases in staff size would send the Engineers back to the Alexander Young Building. For most of Major Bermel's tour, then, the Honolulu District resided at Pier 2A on the waterfront at Honolulu Harbor. Behind the increase in staff size and the District's consequent move in the late 1930's lay both the navigation project at Midway and the new activities of the WPA. On the mainland, Corps of Engineers officers were loaned to the WPA to assist in recovery programs; in Hawaii, from April 1938 to April 1943 the District Engineer actually served as WPA Administrator. Responsible for a year for both PWA and WPA tasks in the Territory, Major Bermel expanded the District's horizons far beyond the Engineers' original fortification and navigation functions.

As WPA administrator after April 1938 the District Engineer was to recommend or veto the Territory's WPA projects, although officials in Washington had the final say on approval and funding. Local interests immediately expressed their concern that, with the assignment of WPA administration to the U.S. Engineers, Federal projects such as Army airfield construction would take precedence over local or civilian jobs such as road and drainage work. These interests also feared that consolidation with the Engineer District would mean elimination of many WPA administrative jobs. Major Bermel at first assuaged these doubts by keeping all 2,500 laborers on their jobs in April and by increasing this number to almost 3,000 within a few months. His District office did absorb several sections of the WPA administration, however, with resulting cuts of approximately 30 white-collar personnel. By November 1938 all the WPA offices formerly at Merchant and Bethel Streets had joined the Engineers at Pier 2A. Several civilian WPA projects were closed down in 1938 so that more men might work on Federal jobs; in June 1938 Army and Navy projects reportedly employed 2,300 of the 2,700 WPA workers available on Oahu.

At the same time, Major Bermel announced the start of four new construction projects: the extensions of Kalihi-uka and Mokauea Roads, the repair of Gulick Avenue, and the widening of the Moiliili Bottleneck. He also recommended six new white-collar programs related to library and bookbinding work which could employ as many as 189. The balance sheet still showed a reduction in WPA jobs and a shift from civil to military projects; however, according to Congressional Delegate Samuel King. King had protested the transfer of the WPA administration in April, and now, in June 1938, he sought to have Major Bermel relieved of his WPA duties on the grounds that the Army officer was not a resident

of the Territory.

King did not succeed in his attempt to oust Major Bermel but did attract some sympathizers, who perhaps did not realize that by 1938 cutbacks in WPA projects were occurring nationwide. Reduction in force was not the only WPA issue over which officials in Hawaii clashed with Major Bermel. In July 1939 the District Engineer objected to the use of volcanic cinders in paving Ala Moana Boulevard and insisted the City and County of Honolulu supply crushed rock. In response, Mayor Charles S. Crane suggested the Engineer officer contact local experts familiar with volcanic roads.[5] One month later Major Bermel complained that sections of the new boulevard were being ripped out for the installation of water pipelines which should have been laid beforehand, and he suggested that the local government pass an ordinance requiring underground utilities to be placed prior to construction. The City and County agreed that the lines should have been laid earlier but took no steps to enact the proposed legislation.[6]

Subject of the harshest dialogue between Major Bermel and local interests was the Kona belt road on the island of Hawaii. The Big Island had counted on continued WPA construction of the Kona section of the belt road when Major Bermel took over in 1938 and was most disturbed when in January 1940 he ordered work halted on the two portions already begun. Claiming that the County of Hawaii had not contributed its financial share, the District Engineer threatened to reduce the Big Island's quota of WPA workers and to start no new projects there unless ordered to by Washington. Charges by the County that the WPA has mismanaged the job increased the bitterness of the dispute. In March 1940 Major Bermel and Major Pohl visited Hawaii and reached agreement with County representatives: a supplementary project application for continuing work on a portion of the belt road would be submitted to Washington, and the County would finish the present project sometime in the future.[7]

The disagreements between the District Engineer and the residents of Hawaii stemmed in part perhaps from Major Bermel's volatile, energetic personality. Whereas Major Scott had introduced the District to Hawaii with a demure bow, Major Bermel reintroduced the Engineers with a brusque handshake. Also responsible, however, was the expansion of the District into new areas in the 1930's. At the start of the period Major Crawford handled only a few fortification projects and maintained four harbors; in the middle of the decade Major Scott also supervised the Public Works Administration in Hawaii and planned new navigation work at Honolulu, Kaunakakai, and Port Allen. By the end of Major Bermel's tour, the District Engineer administered both PWA and WPA activities and was responsible for an increasing number of harbor projects throughout the Pacific. As the District grew and became more involved in local affairs, the Engineers naturally met more resistance to their endeavors.

From 1931 to 1939, then, the workload of the Honolulu District had increased in scope as well as in size. Among the new fields into which the District had expanded were the blasting of coral reefs, the maintenance of a faraway field office, and the study of lava flows on the Big Island. In this period, too, even more than in earlier years, the Engineers' history followed current events. To the Depression the District owed the slow pace of work from 1931 to 1933; to the Depression the District owed the later delegation of PWA and WPA duties and the Federal adoption of three harbor projects. Defense requirements as well as commercial developments led to the important Midway project, which involved the District in new dredging techniques and in new areas of geographic jurisdiction. The relations maintained between the District and local interests during Major Bermel's tour continued during the Second World War, as did the increased variety of the District's work, the geographic range of that work, and the effects of world history on the Honolulu Engineers. The decade of expansion of the 1930's anticipated even greater activity for the Honolulu District during World War II.

Footnotes — Chapter IV

1. The **Honolulu Star-Bulletin**, 20 February 1929, p. 1, col. 3.
2. The **Honolulu Advertiser**, 29 April 1934, p. 7, col. 3.
3. U.S. Army Engineer District, Honolulu, **The Trade Wind**, November 1939, pp. 8-9.
4. The **Honolulu Advertiser**, 19 December 1937, p. 15, col. 1.
5. **Ibid.**, 9 July 1939, p. 3, col. 2.
6. **Ibid.**, 9 August 1939, p. 1, col. 1
7. **Ibid.**, 26 January 1940, p. 2, col. 4, and 8 March 1940, p. 2, col. 5; The **Honolulu Star-Bulletin**, 25 January 1940, p. 1, col. 4, and 10 February 1940, p. 2, col. 4.

CHAPTER V: Defense Buildup

Although attention usually focuses on the post-1941 period in Hawaii's wartime history, the two years immediately prior to the attack on Pearl Harbor also saw an unprecedented rise in defense activity on Oahu. Even before the assignment of Army Air Corps construction in Hawaii to the Corps of Engineers on 6 January 1941, an accelerated program of coastal defenses and air warning stations signaled a larger workload for HED. With the transfer of Air Corps construction to the Engineers came the ferry route program in the Pacific, a mushrooming contract with Hawaiian Constructors, and consequent growth within the District office. During these two years just before America's entry into the war the Honolulu Engineer District ventured into new endeavors in response to global events.

The fears of Japanese aggression which had contributed to the authorization of the harbor project at Midway had increased by 1940. In 1931 Japan had occupied Manchuria; six years later she invaded China itself; and in December 1937 she sank the U.S. gunboat **Panay**. These threats from the Pacific and obvious German designs in Europe at the same time resulted in increased defense measures by the United States.

In Hawaii, the accelerated defense program centered around the construction of a network of aircraft warning stations. The War Department Board which met in December 1939 planned three fixed stations, six mobile stations, and one information center, which were authorized for construction by the War Department in June 1940. The peaks of Kaala on Oahu (elevation 4,000 feet), Haleakala on Maui (10,200 feet) and Kokee on Kauai (4,225 feet) were chosen as sites for the fixed stations, while in 1941 additional authorizations brought the total of fixed and mobile stations to twelve. Although none of the stations was in operation on 7 December 1941, by that date the Engineers had built housing at Kaala, had almost completed the station at Haleakala, and had finished two-thirds of the work at Kokee. Several stations were functioning by April 1942. Later criticized for its slow progress on the AWS system, the District experienced understandable difficulties during construction. Dense vegetation hindered access to the sites, for example; negotiations with the Park Service over rights to Haleakala lasted almost a year; and the attack on Pearl Harbor later necessitated new, splinterproof design. In constructing these aircraft warning stations in 1940 and 1941, the Honolulu District reaffirmed its adaptability to changing methods of attack. In the 1920's HED's fortification responsibilities consisted of coastal gun batteries and ammunition storage plants for use against enemy vessels; in the 1930's the danger of air attack necessitated searchlight positions and anti-aircraft emplacements as well. Now in 1940 the growing threat of surprise invasion from the air extended the District's fortification duties to the construction of aircraft warning stations in Hawaii.

At the same time, the Honolulu District began to improve the seacoast defense system constructed 20 years before. With the $1.2 million appropriated for that purpose between April 1939 and July 1940, in 1941 the Engineers splinterproofed and concealed the existing batteries at Fort Kamehameha, built several new seacoast batteries near Kaneohe Bay, and erected another on the south rim of Punchbowl Crater overlooking Honolulu. Four additional batteries were constructed for the twelve guns given to the Army by the Navy. In these projects the District cooperated with the Signal Corps, the Department of Ordnance, the Seacoast Artillery Command, and other War Department units; in building access railroads as supply lines to the gun positions the Engineers worked closely with the Oahu Railway and Land Company. The maintenance and repair of fortification works were included among the duties of Area Office 1, established at Pier 2A on 3 December 1940. Additional gun emplacements at Diamond Head Crater and north of Schofield Barracks were constructed in 1942, as a continuation of the program begun over a year before American entry into the war.

To handle the increased defense activity on Oahu, on 20 December 1940 the Honolulu District entered into a cost-plus-fixed-fee contract with a joint venture named Hawaiian Constructors. Normally the District might have employed hired labor, but by fall of 1940 workmen were scarce and the emergency nature of most defense projects did not allow much time for recruitment. Nor was there time to prepare detailed plans, to advertise for bids, and to award the contract to the lowest responsible bidder. In July 1940, therefore, Congress approved the use of cost-plus-fixed-fee contracts, and in October 1940 the

South Pacific Division Engineer, Colonel Hannum, came to Hawaii and agreed that time limits justified the Honolulu District's use of such contracts. OCE added its approval on 4 November 1940.

When the District Engineer, Lieutenant Colonel Theodore Wyman, Jr., found local contractors already busy on other defense projects, then, in 1940 he visited the mainland and recruited three firms there. The W. E. Callahan Construction Company, the Gunther and Shirley Company, and the Rohl-Connolly Company formed the joint venture called Hawaiian Constructors and on 20 December 1940 signed W-414-eng-602, a negotiated contract in the amount of $1,097,643, with a fixed fee set at $52,220. Approved by the Chief of Engineers, the Undersecretary of War, and the Advisory Commission to the Council of National Defense, the original contract called for building fortifications, aircraft warning stations, and ammunition storage facilities; for laying more railway track; and for making additions to radio station WTJ at Fort Shafter. After receiving plans and specifications from the District, Hawaiian Constructors would develop detailed construction planning to meet the approval of the Engineer officer in charge of the field area in which the particular project was located. The contractor was to be responsible for transporting materials from Engineer supply yards to the project sites, for supervising its work crews, and for otherwise administering its own organization.

During the next two years the contract with Hawaiian Constructors assumed vast proportions as supplemental agreements were added and the contractor's jurisdiction expanded. In the summer of 1941 a local contractor, Ralph Woolley and Company, became a co-adventurer in Hawaiian Constructors, and in January 1942 the Hawaiian Contracting Company also joined the venture. After the transfer of Army Air Corps construction, on 19 May 1941 the District signed a defense contract for $1.8 million with the Territorial Airport Constructors, a joint venture of the W. E. Callahan Company, Gunther and Shirley, and Paul Grafe, to improve Territorial airports with Civil Aeronautics Authority (CAA) funds. This contract was terminated on 20 December 1941, when some of the venture's remaining work was transferred to Hawaiian Constructors under contract no. 602.

By December 1941 ten supplemental agreements had increased the estimated cost of work under the Hawaiian Constructors contract to $19,545,557 and had raised the fixed fee to $455,145. By the following March, when the contractors had taken over the huge airfield construction program, the contract totaled nearly $75 million, and additional supplemental agreements raised the estimated cost of work to $84,436,887 in May 1942. The fixed fee had meanwhile grown from $52,220 to $1,014,690. The contract was terminated in January 1943 and finally settled in May 1944, when the total cost of work was set at $112,031,375 and the fixed fee at $1,215,597, plus a supplementary fee of $1,060,000 resulting from termination. Fifty-two supplemental agreements had been added.

This tremendous growth of the District's major contract was accompanied by the gradual absorption of the contracting company itself into the Honolulu District. In February 1941 the District Engineer directed that a general job order be issued for each phase of work; the District Engineer and a Control Board would determine the control of operations, engineering, and employment; and at the Board's weekly meetings the contractor would present his plans for the approval of the District Engineer. Thus the contractor was to report directly to the District Engineer, instead of to the Engineer in charge of the local area office. In May 1941, then, a directive from the Undersecretary of War resulted in the District Engineer's taking over the contractor's timekeeping, payroll preparation, and supply procurement functions; henceforth the contractor would be responsible only for construction. To take further advantage of the District's already established organization, during 1942 a number of defense projects were actually transferred from Hawaiian Constructors to the U.S. Engineers. When on 31 January 1943 the cost-plus-fixed-fee contract was terminated, all operations were reassigned to the U.S. Engineer Department, which continued to employ the contractor's personnel as hired labor.

The criticism attracted by the contract with Hawaiian Constructors is discussed further in Chapter VI. Both the contractor and the Engineers were accused of inefficiency; Lieutenant Colonel Wyman was suspected of favoritism in awarding the contract to a mainland concern; and the District Engineer was also criticized for his relations with Hans Rohl, President of the Rohl-Connolly Company and a German citizen at the time the defense contract was signed. These charges cannot minimize the significance of the huge workload handled by the Engineers through this contract, however. When the contract was negotiated in the fall of 1940, "defense" construction meant primarily aircraft warning stations and gun emplacement repairs in the Hawaiian Islands. With the transfer of all Army Air Corps construction in Hawaii to the Corps of Engineers only two weeks after the award of the contract, the District added much of the new airfield construction to the defense contract and thus enlarged the contract's scope far beyond its initial boundaries. The nationwide transfer of the Army's Air Corps construction from the Quartermaster Corps to the Corps of Engineers in December 1940 and January 1941 thus had special significance for the Honolulu District. Less than a year later the Japanese bombing of Hawaii's major airfields would necessitate extensive rehabilitation, while America's entry into the war would call for a massive program of new airfield construction in the islands. Even before the attack on Pearl Harbor, the addition of military airfield projects resulted in a greatly expanded work-

load for the District. Lieutenant Colonel Wyman had just supervised the completion of the harbor project at Midway, still administered the WPA program in the Territory, and was busily engaged with accelerated defense activities in Hawaii. To these tasks he now added the responsibility for Air Corps construction.

On 6 January 1941, 24 lump-sum construction contracts totaling $6.5 million were transferred to the Honolulu Engineer District from the Quartermaster Corps. Much of the work to be accomplished under these contracts was located in the Hawaiian Islands and consisted of a program of Territorial airport construction financed by the CAA. With the $7,170,273 received from the CAA between January 1941 and December 1944, the Engineers planned and constructed approximately 37 miles of runways and 32 miles of taxiways. The attack of 7 December refocused the District's energies in Hawaii from new construction to repair and extension of existing fields.

Since the District's rapidly increasing functions required greater decentralization and delegation of authority, several field offices were established in late 1940 and early 1941. Most of these handled construction within a specific geographic area; some, such as the Grading and Paving Area or the Tunnel Area, were functional rather than geographic units. Mr. George A. Sisson supervised Area 2, located at Hickam Field and organized on 13 January 1941 primarily to oversee the work at John Rodgers (now Honolulu International) Airport. Here coral fill dredged from the adjacent Keehi Lagoon seaplane runway project was built up by hydraulic dredges to an elevation of 8 feet above low water. Filling began in October 1941 and grading and paving operations completed the three runways in August 1943. Construction completed in late 1941 at Hickam Field included a hospital, a dental clinic, an engineering shop, an engine repair building, barracks, a noncommissioned officers club, a swimming pool, and a fence around the reservation.

The Engineers were especially proud of the work carried out between 31 March 1941 and 1 September 1943 by Field Area 5, located at Bellows Field. Under the direction of Mr. Paul J. Lynch, in 1941 this area bulldozed and cleared the land at Bellows, constructed barracks, and installed utilities to transform the sandy site into a modern unit of the Air Corps. The Engineers had already begun the construction of runways and taxiways when the Japanese attacked the field; by 14 December Mr. Lynch's forces had extended Runway B from 2,200 feet to 4,900 feet so that B-17's from the mainland could land and take off for the Orient. The field area completed this task, in blackout and rain, only one hour before the first four U.S. planes landed at Bellows.

The 3rd Field Area, located near Wheeler Field and Schofield Barracks, and the 13th Area at Kahuku Field also supervised Air Corps construction on Oahu. On Maui, Area Office 6, established in May 1941, was located in the American Legion Building at Wailuku and was under the direction of Mr. A. H. Wong. This area handled WPA projects as well as airfield construction on Maui, Molokai, Lanai, and Kahoolawe; Mr. Wong combined the CAA and WPA functions of the District by employing WPA labor to construct the Territorial airport at Homestead Field on Molokai. Among the more interesting tasks of the 6th Field Area was road construction on Maui: to build the 2.3-mile Kihei Road from the Naval Air Base to Kihei town, crews labored in 103 degree heat, while to construct the 10¾-mile trail up the slopes of Haleakala, workers were chilled by 40 degree temperatures at elevations up to 10,000 feet. Paralleling the 6th Area on Maui was the island of Hawaii's Area Office 7, which was established in May 1941 to supervise WPA work at Hilo Airport and at Morse Field. In June 1941 Area Engineer Captain Charles D. Baker added to his responsibilities the CAA contracts for construction of the Territorial airports at Hilo and Upolu Point. By October the office had completed all access roads at Hilo and Morse Fields and most mobilization buildings and utilities facilities at the two sites. This office employed WPA workers as well as two companies of National Guard troops on its varied construction projects. Area Office 4 meanwhile managed the District's construction projects on Kauai.

Although these area offices handled WPA projects as well as the CAA program, it was Air Corps construction that made up the bulk of their workload. Closely associated with the extensive airfield development under the Honolulu District in 1941 was a series of projects for gasoline and ammunition storage in Hawaii. In his definite project report on the installation of war reserve aviation gasoline storage in the islands, submitted in June 1941, Lieutenant Colonel Wyman recommended a site near Aliamanu Crater for aviation fuel storage for Hickam and another site at Waikakalaua, near Schofield Barracks, for storage for Wheeler. Concluding that complete concealment was not feasible on Oahu, the District Engineer suggested cut and cover protection for the proposed tunnels. The District's Design Division drew up plans for this war reserve aviation gasoline storage system; by late November 1941 Hawaiian Constructors was assembling equipment for construction of the storage site in Waikakalaua Gulch. A similar underground aviation gasoline storage system was also planned for Kipapa Gulch, and steel igloos above the ground were designed for ammunition storage at Hickam. Although construction on most of these projects and on related jobs on Molokai and Hawaii did not begin until spring of 1942, the District had planned for aviation fuel and ammunition storage in the Territory in early 1941.

The transfer of Army Air Corps construction to the Corps of Engineers thus created new work in airfield paving and gasoline storage for the Honolulu District. Important as this work in the Hawaiian Is-

lands was, however, the Engineers were proudest of the overseas airfield construction they accomplished for the Pacific ferry route. The old, heavy bomber route from the U.S. to the Philippines crossed Midway, Wake, and Guam and was exposed to possible attack from the Japanese mandated islands in that area. With a wary eye on the Japanese in the fall of 1941, therefore, the United States decided to build a safer route through the islands of the South Pacific and Australia. A War Department directive of 4 October 1941 ordered Lieutenant General Walter C. Short, Commanding General of the Hawaiian Department, to begin construction of the new route in a matter "of weeks and not years." By 13 October 1941, General Short had determined the path of the route through Christmas and Canton Islands; Fiji; Townsville or Rockhampton, Australia; and Darwin. At the same time General Short delegated the construction of the necessary airfields, the supply of the island bases with equipment and personnel, and the subsistence of working forces on the islands to the Honolulu District Engineer. Two weeks later the Secretary of War reassigned the development of the air bases west of the Solomon Islands to the Commanding General of the U.S. Army Forces in the Far East while leaving Lieutenant General Short with the responsibility for construction of the rest of the route.

The Honolulu District responded quickly to the emergency nature of the ferry route construction and on 6 November signed a cost-plus contract with the St. Louis firm of Sverdrup and Parcel for architect-engineering services in connection with the route. Mr. Leif J. Sverdrup was to be the District Engineer's personal representative on the South Pacific islands for this airfield project. On 7 November Mr. Sverdrup and Captain Robinson left for the South Pacific to establish liaisons with the local governments. To construct the first 5,000-foot runways on Canton, Christmas, Fiji, and New Caledonia by the 15 January 1942 deadline, the District Engineer established field areas at all four locations and assigned most of the construction to Hawaiian Constructors under supplemental agreements to contract no. 602.

Captain Charles D. Baker served as Area Engineer at Canton, where the first District field office for the ferry route, Area 8, was established in October 1941. Among the plant sent to this island were the USS **Antares**, a Navy vessel used to transport men and material; the U.S. tug **Monterey**; and the dredge **Holland.** Leaving Honolulu on 3 November, the first expedition of Engineer forces arrived at Canton on 14 November 1941. The lack of living facilities and delays in procuring equipment from Honolulu and the mainland were accentuated after 7 December, and a week after the attack all two hundred civilian personnel had to be evacuated by barge and tug to Pago Pago. In spite of these obstacles, in the five weeks between 14 November and 23 December 1941 the Engineers constructed a landing strip 5,000 feet long and 200 feet wide. Plans for the island air base expanded as the war progressed, and a total of three coral runways, one as long as 9,000 feet, were completed at Canton by the time Area Office 8 closed in June 1943.

Similar progress took place at Christmas Island, another important link in the Pacific chain, where a survey party from the District Engineer's office had arrived as early as 20 October. Maj. John Shield became Area Engineer when the office opened on 8 November. The following week saw the arrival of cargo and men on the SS **Haleakala**, the first of several vessels chartered by the District from the Inter-Island Steam Navigation Company in Honolulu. Later in the war the Engineers would charter the entire IISN fleet. Clearing and grading of the NE / SW runway began on 5 December but was interrupted two days later as construction slipped in priority behind the needs of defense and protection. The fear of capture by the Japanese created tension among all forces at Christmas and was probably responsible for some of the friction between Major Shield and the Hawaiian Constructors foremen. Disputes over jurisdiction may have slowed down the progress of the airfield, but the runway was completed on 20 January 1942 in time for the next day's landing of a U.S. B-17. Area 9 at Christmas was closed and the Task Force commander took over all airfield and housing construction there in July 1943.

The Engineers encountered unusual circumstances at Fiji. Though a Crown Colony of the British Empire, these islands had been placed under control of New Zealand's military forces for protection and defense. As Colonel Wyman's representative, Mr. Sverdrup signed an informal agreement of cooperation with the New Zealand Prime Minister in April 1942, and New Zealand provided natives and skilled labor for much of the construction on Fiji. Captain Carl Ende supervised Area Office 11, which was established on 18 November 1941. Construction at Fiji included a 5,000-foot runway built between 29 December 1941 and 15 January 1942 at Nandi; ten gasoline storage tanks; and housing at Narewa for Air Corps troops. Although most of the work here was completed by June 1942, difficulties in auditing New Zealand records resulted in the temporary relocation of the Suva office in Wellington in December. The office closed in April 1943 after almost two years of excellent cooperation from the government of New Zealand.

Dealing with the English-speaking forces of New Zealand on Fiji proved an easy task compared to the District's relations with foreign representatives at New Caledonia. Since this territory belonged to France but relied on Australian military support for its defense, the District Engineer signed an agreement with the Australian Commonwealth so the U.S. could develop air bases on the island. When Second Lieutenant Richard P. Sauer took over Area Office 12 in mid-November 1941, the German conquest of France had already created two French govern-

ments: the "neutral" administration at Vichy and the "Free French" forces under General Charles de Gaulle. Which French government should the Engineers assume had jurisdiction over New Caledonia? The question was answered on 11 December 1941 when General de Gaulle instructed his representatives to cooperate with the U.S. and Australian forces at New Caledonia. From then on, the Engineers dealt with the Free French. By 27 December 1941 the 5,000-foot runway was completed at Tontouta; in January 1942 work began on three 7,000-foot runways at Paines des Gaiacs. In April 1942 U.S. Task Forces took over the ferry route project at New Caledonia.

As the first airfields at these islands reached completion in December 1941 and January 1942, just after the attack on Pearl Harbor, the U.S. began to fear similar attacks and the possible capture of Fiji and other islands in the new ferry route. Thus on 25' January 1942 the District Engineer suggested that an alternate route be developed through the Marquesa, Society, and Tonga islands. When Lieutenant General Short's relief, Lieutenant General Delos C. Emmons, approved a survey in late February, Colonel Wyman sent Leif Sverdrup as his personal representative to investigate 13 islands as possible sites for the alternate route. On the basis of his experience with the original ferry route projects, Mr. Sverdrup selected Penrhyn and Aitutaki, both possessions of New Zealand, and Tongatabu in the British protectorate of Tonga. On 25 April 1942 his firm signed a contract for construction of the runways at these three islands, and on 11 May the District received permission from Washington to proceed with the airfield construction. Area offices were established by 13 May on all three islands.

At Penrhyn, the Engineers imported native labor from nearby islands to construct a 7,000-foot long, 300-foot wide coral runway. Construction began in July 1942; the first plane landed on the completed runway on 9 October. Aitutaki saw similar progress: work by hand began in June; equipment arrived in August; and a 6,000-foot NW / SE runway and two seaplane runways were completed in November 1942. The Task Forces already at Tongatabu argued for permission to build the airfields, but the Engineers insisted that they were to do the work and constructed the three runways between 1 July and 22 November 1942. When the natives at Tongatabu discovered the profits they could reap by selling tropical fruit to the armed forces, the construction supervisors resorted to recruiting native labor from other islands and housing them in huts at the airfield. The fields and related facilities at all three sites were turned over to task forces in late 1942 and early 1943.

Among the Engineers' handicaps on the ferry route project were the lack of regular shipping, poor communications, tension resulting from unprotected positions, and plagues that kept architect-engineers from leaving the U.S. Even when the South Pacific Division Engineer acted as the Honolulu District Engineer's agent in shipping supplies directly from the mainland to the Pacific islands, delays continued. Partly because of difficulties such as these, Colonel Wyman frequently expressed understandable pride in the District's accomplishments on the ferry routes. In his letter to Engineer and Hawaiian Constructors employees at the time of his departure in March 1942, the District Engineer declared:

> Among other accomplishments of this District was the construction of airdromes in the Hawaiian Department tripling, in the short period of two months, the aviation facilities that existed in these islands on December 7, 1941. Here reference is made to the complete program of airport construction in the Pacific area. So far as the District Engineer knows, this is the greatest construction achievement of the Hawaiian Department either before or since the enemy attack on Pearl Harbor.1

In the fall of 1942 Colonel Wyman received the Distinguished Service Medal for meritorious service in directing emergency construction at isolated points in the South Pacific "under extremely difficult conditions of supply and construction." The citation noted that the District Engineer had completed most of the work more than two weeks ahead of schedule.2 Regardless of the criticism later leveled at Colonel Wyman, and discussed in Chapter VI, his Engineers had accomplished an incredible amount of airfield construction in a short time and at great distances from the home office.

The ferry route project introduced the Honolulu District to more new tasks than the Engineers could have envisioned two years earlier: the District dealt with both **de jure** and **de facto** governments, chartered vessels of Hawaiian firms, and labored on foreign soil under fear of attack by enemy bombers. In establishing an office-away-from-the-office at Midway in 1938 the Engineers had prepared themselves somewhat for the extensive construction they were now called upon to accomplish on other islands in the Pacific. Of interest, too, was the nature of the work at each of these stages in the District's history: at Midway in the 1930's the Engineers constructed a seaplane harbor for clipper craft, while now in 1941 they built coral runways for newer, land-based planes. New developments in aircraft prompted new endeavors for the Honolulu Engineers.

In order to handle the increased workload which resulted from the transfer of Air Corps construction in Hawaii to the Honolulu District, the office underwent several organizational changes during 1941. The District Engineer ordered a reorganization of the District just one week after the assignment of airfield construction and at that time established three field areas on Oahu and one each on Hawaii, Maui, and Kauai. Four divisions were organized within the District: Mr. Philip E. Chew supervised

Administration, which included sections for Personnel, Finance, Miscellaneous, and Property; Lieutenant Colonel Wyman had charge of the Engineering Division, with Mr. Simon L. Perliter as head of the Military Subdivision and Mr. Camille Rossi leading Civil affairs. Until 17 February 1941 the District Engineer also administered the Operations Division, while Major Robinson was in charge of the Transportation and Supply Division, including the operation of the base yard at Fort Kamehameha. Lieutenant Colonel Wyman soon delegated increased authority to Major Robinson, who was appointed Operations Officer on 17 February. The Major directed many of the negotiations between the District and the foreign governments of the South Pacific islands on the ferry route.

The new airfield construction projects required other changes within the office. Among the new departments created in 1941, for example, were the Procurement Section of the Operations Division and an Airport Design Section under the Civil Engineering Division. The Airport Design Section became a subdivision later in the year. Between January and June 1941 the staff of the Procurement Section rose from 11 to 22; by midyear the Engineering Division consisted of five subdivisions. This growth characterized the entire office, for whereas on 1 December 1940 the District employed 480 men and had one field area, by June 1941, seven months later, the staff had risen to 1,214 and the Engineers maintained seven area offices. Since this expansion called for more space, in early 1941 the Honolulu District's main office returned to its original home, the Alexander Young Building on Bishop Street. The District moved partially and gradually, leaving some staff at the base yard at Pier 2 and at field offices scattered around Oahu.

As the District expanded in 1941 so did its staff's activities, and the camaraderie noted in the 1930's soon infected new employees as well as old. The recent addition of so many new staff members prompted the redesignation in June 1941 of **The Trade Wind** as **Safety**, a magazine aimed at encouraging good safety practices but also known to include reports from field areas and tidbits of office gossip. The American Legion Branch established in the spring of 1941, Engineer Post No. 22, attracted the many World War I veterans then on the District's staff. Bowling continued to be popular, while in the summer of 1941 the women of the office formed a softball team under the Government Employees League. The District's benefit dance at the Ala Moana Pavilion on 8 November 1941 provided another opportunity for Engineer employees to enjoy themselves after hours.

By the end of 1941, then, the Honolulu Engineer District had expanded far beyond the imagination of First Lieutenant Slattery or even the thoughts of Major Scott. The District Engineer managed money from the WPA and the CAA as well as regular funds appropriated by Congress; he negotiated 52 supplemental agreements to a contract which eventually totaled over $112 million. Lieutenant Colonel Wyman's projects included aircraft warning stations in Hawaii, gasoline storage facilities in the Territory, and airfield construction on islands ranging from Oahu to Penrhyn. At the same time, the District continued its work on seacoast defenses and dredged harbors at Keehi and Kapalama. Once again, variety in response to national defense requirements marked the work of the Honolulu District. In the same way that the Corps' peacetime jobs keep the Engineers in shape for their eventual wartime duties, these years of accelerated defense activity would serve as excellent preparation for the District's even greater expansion after 7 December 1941.

Footnotes — Chapter V

1. U.S. Army Engineer District, Honolulu, **Safety / The Trade Wind**, December 1941 / September 1942, p. 15.
2. **Ibid.**, October / December 1942, p. 29.

CHAPTER VI: "Oahu Bombed"

Certainly no other Engineer unit in the U.S. or its possessions felt the effects of 7 December 1941 more strongly than did the Honolulu District. The attack on Pearl Harbor propelled the Honolulu Engineers into new fields of work and new regions of the Pacific, as the District's workload increased in direct and dramatic response to the course of the war. Never before had the District supervised projects like the camouflage of the Aloha Tower, the conversion of Oahu's schools into offices, or the supply of forward Pacific bases for a specific military offensive. Never again would the District actually merge with the Engineer Office of the Hawaiian Department of the Army, employ a former contractor's own construction crew, or occupy over 200,000 acres of land in the Territory of Hawaii. So far reaching were the effects of the war, in fact, that during most of the period the Honolulu Engineers existed not as a District but as the Oahu Engineer Service and then as the Construction Service under successive Army commands in Hawaii. The District's new tasks and rapid growth led to even greater involvement with local interests and consequently to Hawaii's continued dissatisfaction with the U.S. Engineers. In spite of this local criticism, however, the Honolulu District performed its duties successfully and contributed significantly to the American war effort. The years from 1941 to 1945 represented HED's proudest — if most taxing — hours.

When the first Japanese planes hit Oahu at 7:55 a.m. on Sunday, 7 December 1941, several Engineer employees were already at work at the District offices at the Alexander Young Building. An employee on duty at Hickam Field reported the attack to Lieutenant Colonel Wyman, who reached the Young Building with Major Robinson by 8:30. The District Engineer's radio broadcast half an hour later ordered all District personnel to report to work; another broadcast that evening directed employees of all retail firms doing business with the Engineers to report for duty immediately. The calm of that Hawaiian Sunday was further shattered in the afternoon, when Lieutenant General Short established martial law in the islands.

To expedite the defense of the island against anticipated additional attacks by the Japanese, by 9:30 a.m. on 7 December, Lieutenant Colonel Wyman had set up a new headquarters of the District office on the waterfront. This forward base, located in the Tuna Packers Cannery at Kewalo Basin, would operate independently of the routine functions of the office at the Young Building. Stopping over in Honolulu on 7 December en route to duty in Africa was a Major Louis J. Clatterbos, Corps of Engineers; unable to leave the islands because of the emergency that morning, Major Clatterbos reported to Lieutenant Colonel Wyman for duty and was appointed Supply Officer at the Kewalo Basin office.

As night fell, the District Engineer realized the exposed position of the Kewalo Basin headquarters, decided to relocate the office further inland, and within a few hours settled on the exclusive and venerable Punahou School as the site of the District's new home. In view of the bitter complaints which soon arose regarding the Engineers' "occupation" of Punahou, it is not likely that the location was suggested to Lieutenant Colonel Wyman by a school trustee, as some have claimed. Nor did the Engineers "stumble upon" Punahou on their way to McKinley High School or the University of Hawaii. The District chose the private school primarily for its sheltered position far back in the hills of Oahu and for its spacious office and storage facilities. Also attractive were Punahou's mess halls and dormitories, for the blackout would force civilian employees working after sunset to board at the office.

In the darkness of night at 2 a.m. on 8 December, then, the first group of U.S. Engineers reached Punahou School. Instead of obeying the watchman's order to extinguish lights, an Engineer officer countered with his own order to open up the school building and admit the Engineers. When the watchman denied the request, District employees pushed open the doors in various buildings and proceeded to "occupy" the campus. Two days later, the District Engineer sent this letter to the trustees of Punahou School:

> Gentlemen:
>
> The forces of the United States Engineer District have occupied the grounds of Punahou School under authority granted to the District Engineer by the commanding general of the Hawaiian Department. The grounds of the school are being used as a base for the field officers of the District Engineer.

At present the length of the occupancy is indefinite and, of course, depends upon the duration of the emergency.

After the buildings and grounds are no longer desired for the use of the District Engineer, they will be restored as far as possible to their original condition at the time of occupancy.

Signed:
Theodore Wyman

The lease signed on 9 January 1942 defined the portions of the campus to be occupied and set the monthly rental of the school's facilities at $20,000.

Once established at Punahou, the District quickly set about to modify the school for Engineer uses. Castle Hall was fumigated, painted, and converted into offices; a floor was laid in Dillingham Hall from the level of the stage back to the entrance to create the engineers' drafting area; Rice Hall became a dormitory, Dole Hall a cafeteria, Old School Hall the Procurement Office. The manner in which the U.S. Engineer Department took over the campus and transformed the school into Army offices naturally aroused the anger of Punahou students, faculty, and friends. USED "took everything over," complained a student observer; the Engineers even pressed into service the cafeteria director, who was told to prepare breakfast for 750 employees at daybreak on 8 December.[2] The occupation had been not only unannounced but also destructive: the rumors that the Engineers had thrown books from the library onto the wet lawn were probably not true, but in constructing a barbed wire fence around the grounds the Engineers had indeed carelessly injured a beloved cereus hedge.[3] Furthermore, on 8 December the forces of Hawaiian Constructors joined the Engineers at Punahou, and soon after the transfer of all army construction to the Corps of Engineers, in December 1941, two hundred of the Zone Quartermaster's former employees also reported for duty at the school. The few offices which had remained in the Young Building on 8 December moved to Punahou during the first half of 1942 and thus further increased the number of workers at the school.

As a sequel to the transfer of Air Corps construction to the Corps of Engineers the previous January, the War Department planned later in the year to assign the responsibility for all Army construction to the Chief of Engineers. Public Law No. 326, 77th Congress, approved 1 December 1941, provided for this transfer effective 16 December 1941. Since the attack of 7 December called for emergency action in Hawaii, however, Lieutenant General Short directed the transfer in Hawaii to take place on 8 December, almost a week earlier than originally scheduled. Thus one day after the U.S. entered the Second World War, the Honolulu Engineer District enlarged its responsibilities to include the construction and maintenance of Army buildings and utilities in the Territory of Hawaii.

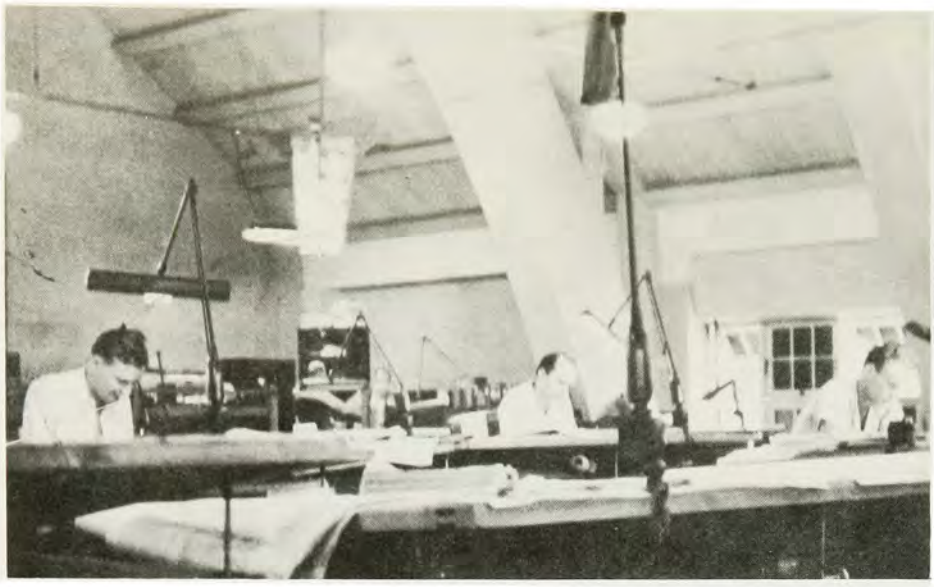
The attack on Pearl Harbor also necessitated an immediate reorganization of the various Engineer services in Hawaii. In accordance with plans drawn up earlier, Colonel Albert K. B. Lyman, Engineer on the staff of the Hawaiian Department, took charge of all Hawaii's military Engineer units, including the Honolulu Engineer District. As District Engineer, Lieutenant Colonel Wyman was to keep the Department Engineer supplied with construction personnel and equipment. Lieutenant Colonel Wyman was given the responsibility for constructing shelters in Honolulu, maintaining airdromes in the Hawaiian Department, and repairing the islands' permanent fortifications. In addition, the District Engineer would assist local civilian agencies in keeping open the main lines of communication. Thus placing the Honolulu Engineer District under the supervision of the Department Engineer achieved a partial consolidation of the various Engineer units in the islands. The arrangement effected in December 1941 represented the first of several such wartime reorganizations which soon resulted in the merger of the forces of the Department and the District Engineers. The charts in Appendix C trace these various changes in Engineer organization during the war.

For the three months immediately following American entry into the war, the Honolulu Engineer District remained a distinct unit, separate from the Engineer office of the Hawaiian Department and led by its own District Engineer, yet responsible to the Hawaiian Department for most of its activities. Reflecting the defense-oriented duties of the District were the many new units established right after the attack on Pearl Harbor: the Camouflage Section, the Petroleum Products Control Section, the War Savings Bond Office, and the Labor Supply Section, for example. The Executive Office, headed by Lieutenant Colonel H. B. Nurse, played an increasingly important role after December 1941. So did the Supply Division, which had been organized at Kewalo Basin on 7 December under Major Clatterbos and which continued at Punahou after January 1942 under Captain Carl H. Trik. Procurement proved one of the District's major problems during the war, as equipment piled up on the west coast to await transportation to Hawaii. Also suffering from growing pains was the new Transportation Office, which eventually was responsible for over 4,000 Army vehicles on Oahu as well as some 6,000 scattered items of heavy equipment. The entire District office increased in size during the three months following the Pearl Harbor attack. As of 15 December 1941 the Engineers employed about 3,000 civilians and Hawaiian Constructors about 8,000; by April 1942 these figures had almost doubled, for Engineer employees totaled 5,491 and the contractor maintained 15,950 on the rolls. Tremendous growth thus characterized the District during the last few months of Colonel Wyman's tour.

The increased staff was spread out among the newly enlarged units at the District's Punahou head-

Men on duty with the HED at the time of the attack on Pearl Harbor. Back row, left to right: Second Lieutenant E. B. Rolland; Second Lieutenant Richard P. Sauer; First Lieutenant DeWitt C. Butz; Captain W. P. McCrone. Front row, left to right: First Lieutenant Henry E. Wilbert; Major B. L. Robinson; Lieutenant Colonel Theodore Wyman, Jr.; Major J. Shield.

Punahou School campus, headquarters for the US Engineers during World War II.



Engineers at work on the upper level of Dillingham Hall, Punahou School, during World War II.

Excavation for a bombproof shelter on Oahu, 1942.

Base yard 17, Oahu, where portable barracks were constructed, 1942.

quarters and among the various field offices established in 1941 and 1942. At the time of American entry into the war, the District operated the seven field areas in Hawaii which had been organized primarily for WPA work and airfield construction projects. These were located at Pier 2A in Honolulu; Hickam Field, Oahu; Wheeler Field, Oahu; Waimea, Kauai; Bellows Field, Oahu; Wailuku, Maui; and Hilo, Hawaii. In addition, field offices were just being set up at Canton, Christmas, Fiji, and New Caledonia. Now, between December 1941 and March 1942, four more Engineer offices appeared on Oahu: Area 10 at Kapalama Basin; Area 13 at Kahuku on the north shore; Area 14 at Pearl City; and Area 15 at Punahou School. Areas 16, 17, and 18, on Penrhyn, Aitutaki, and Tongatabu, were organized for the alternate ferry route project in May 1942.

Supporting these area offices were numerous base yards established for storage and supply. Before 7 December the District maintained only one base yard, at Fort Kamehameha, plus two small warehouses for supply storage. The assignment of all Army construction in Hawaii to the District on 8 December called for additional space; by the end of the war, the Engineers had established over 25 yards in Hawaii and the Pacific islands. Many of these were deactivated as new facilities were created, however, so that only 15 or 20 remained by July 1945. These base yards brought the Engineers into even closer contact with local interests. During the first few months of the war, Procurement Section clerks scoured the city for "useful junk" which had been discarded before the attack but which might prove useful in a base yard. Yard 6, organized on 4 January 1942 for storage and issue of Engineer supplies and redesignated three weeks later as a plant assembly and repair yard, occupied a 26½-acre site leased from Iolani School. Hotels as well as schools fell under the District's wing: in February 1942 the Engineers announced their intention to acquire the use of the Young Hotel roof garden, a favorite luncheon spot of local businessmen.

During these early months of the war the District reached out into the community in yet another sense. USED had been assigned the responsibility for procuring labor, materials, equipment, and supplies to prepare the islands against enemy invasion. What better source of labor and heavy equipment, reasoned the District Engineer, than the Territory's sugar and pineapple plantations? The plantations' attorneys reasoned differently, however, and advised the plantations not to enter into contract with the District lest crop production be curtailed and stockholders bring suit. USED then received authority from the Military Governor, Lieutenant General Emmons, to obtain such labor, materials, and equipment as the District Engineer judged necessary for the defense of Hawaii. Armed with this general order, District representatives persuaded the various companies to sign the "Plantation Agreement," contract W-414-eng-1599, on 1 January 1942. The Engineers would give the plantations 62 cents per hour per worker and the plantations would return 41 cents of this, plus benefits, to each laborer. By the end of the war the U.S. had paid approximately $6 million to the plantations for labor and equipment.

The rapid growth of the Honolulu Engineer District between December 1941 and March 1942 was thus evidenced by a great increase in personnel and by HED's expansion from one main office into a network of field areas and base yards scattered throughout the islands. Even plantation workers came to know the U.S. Engineers. Justifying this expansion, of course, were a dramatically increased workload and the undertaking of many new tasks. From its establishment in 1905 up to December 1941, for example, the Honolulu District issued a total of 14,000 purchase orders; in December 1941 alone, the office issued 4,900, while in January 1942 the monthly figure rose to 9,650. The outbreak of war cancelled some nonessential projects previously handled by the Quartermaster Corps: noncommissioned officers quarters at Schofield Barracks, housing at Fort Kamehameha, and piers at Kapalama Basin were among the jobs left uncompleted in December 1941. The Engineers turned instead to defending Hawaii against a possible second attack.

As part of this initial defense program, work on airfield runways accelerated; District employees began repairing Hickam's damaged utilities as early as the evening of 7 December. The aircraft warning stations lagged behind schedule and had to be redesigned twice: in December the Engineers splinterproofed all permanent stations and in January were ordered by Lieutenant General Emmons to make them bombproof. Other aspects of the self-protection phase of the Engineers' war in Hawaii included the construction of air raid shelters for all USED's offices and yards, the digging of trenches for community shelters, and the building of three civilian evacuation centers near Honolulu. The Safety Subdivision meanwhile distributed gas masks to all Engineer employees.

Perhaps most interesting of all these tasks were the District's attempts to camouflage various parts of the island. From the time of the organization of the Camouflage Section soon after the Pearl Harbor attack, every new building planned by the District incorporated camouflage features in its basic design. The Engineers painted zigzag patterns over terminals and canneries and placed plyboard and burlap planes on open fields as decoys. Even Oahu's lei sellers eventually were recruited to weave rags into nets for use in disguising the island's landmarks, while the athletic field at Punahou hosted hundreds of tin cans planted with tropical shrubs which would help camouflage vital installations. The Engineers even attempted — though not too successfully — to disguise Honolulu Harbor's famous Aloha Tower by painting zigzag lines on the tower and on

adjacent piers. Thus camouflage joined the roster of the Honolulu District's unusual endeavors in defense of Hawaii and the nation.

In addition to reinforcing the islands against enemy attack, during the first three months after the bombing the Honolulu Engineers spent some time designing new and modifying old buildings and supplying other forces in Hawaii. In January 1942 the District designed a one-story prefabricated structure nicknamed "the demountable building," suitable for a variety of uses. Most of these 20-foot long structures were constructed as barracks; one such unit, which cost approximately $550, could house 8 or 16 men. The District tested its ingenuity by frequently using canec, a wallboard made from sugar refinery waste, for walls in the demountable barracks. The period from December 1941 to March 1942 also saw the Engineers build two 1,000-bed hospitals near Waipio Canyon and convert part of Farrington High School and all of St. Louis College into hospitals. In constructing these wartime facilities, the Engineers had to alter standard designs to fit the conditions imposed by both the war and the Hawaiian environment. Most structures erected during 1942 were intentionally of temporary rather than permanent construction, since they were subject to enemy attack and would probably be of little use after the war. New buildings contained just one story, to facilitate evacuation; only later, when fears of invasion diminished, would new two-story structures appear. In reviewing standard plans, the District substituted termite guards for heating facilities and single thickness construction for double floors and walls. Although most major new construction projects did not begin until later in the war, in the first few months of 1942 the Honolulu Engineers erected many small, temporary, and ingeniously designed structures.

Civil defense and construction were matched by supply as the third important aspect of the District's work from December 1941 to March 1942. By 14 December the Engineers had "frozen" items ranging from power tools to nuts and bolts. Sales were authorized only to military units and their contractors; where a fortnight's stock existed, the merchandise might be sold to civilians. Even garbage pails disappeared from Honolulu stores within the first few weeks of the war. On 17 December the District Engineer ordered deliveries of lumber and building materials discontinued except to agencies approved by the District office. At the same time, the Engineers chartered several tugs and barges from the Inter-Island Steam Navigation Company and from Young Brothers, Ltd.

By thus commandeering vital materials and equipment throughout Honolulu, the District Engineer managed to supply the needs of the island's Army forces. In procuring these essential supplies, however, and in occupying so much of Hawaii's land, the U.S. Engineers soon found themselves the

Gardeners at Punahou's athletic field tending plants to be used for camouflage in World War II.

Camouflaged water tower on Kauai, early 1943.

target of local opposition. USED base yards and parking lots dotted the islands; noisy Engineer equipment stirred up dust at all hours of the day and night. Residents spread the notion that it was lucky the Japanese had taken Wake before the Engineers got it: "It will be easier to get it back."[4] Some of the criticism focused on the District Engineer himself. In an article in the **Honolulu Advertiser** of 26 February 1942, local columnist Lorrin P. Thurston praised Colonel Wyman but admitted that the District Engineer was "the most cussed-out individual in the Territory of Hawaii" and that his office was considered "a mad-house, filled with officers who didn't know what they were doing or why, but nothing could be done without his okay."[5] Rumors flew concerning Colonel Wyman's temper, and the District Engineer was even accused of tossing the furniture "out of the windows" upon taking over the Pleasanton Hotel.[6] Actually, the taking over of the hotel, rather than any disposal of the furniture, lay at the bottom of the islanders' complaints. The Engineers had occupied the Pleasanton Hotel, the Young Hotel roof garden, numerous public schools in the Territory, and, worst of all, century-old Punahou. The few damages which occurred at that venerable institution seemed to incur the wrath of all Hawaii. As Punahou's President later noted, "For two or three days it seemed as if the Pacific war were a small event in comparison to the partial destruction of the cereus hedge."[7]

The District Engineer quickly ordered Mr. Woolley of Hawaiian Constructors to replace the Punahou hedge, and Colonel Wyman tried to publicize the important work of his office in hopes of gaining more public support. Of course many of the District's duties in those early months of the war had to remain secret. Most local residents had little idea that Colonel Wyman supervised WPA activities, dredging at Keehi Lagoon and Kapalama Basin, CAA projects at Territorial airports, the maintenance of fortifications, Air Corps construction jobs such as hangars and shops, the ferry route to the Philippines, Army construction recently transferred from the Quartermaster, and the extensive work on bombproof storage facilities and aircraft warning stations demanded by the defense emergency. Even if more citizens had known of the District's tremendous responsibilities, however, they probably would have continued to express their resentment of the U.S. Engineers. In fact, when Mr. Thurston's essay favorable to the District appeared in the newspaper early in 1942, a resident called Colonel Wyman's office to ask when the District Engineer had taken over the paper.[8] Most civilians could not understand why an office which only two years earlier had been known for its harbor projects should now be so involved with the Territory's defense. As Major Bermel had reached out into new areas he had upset local interests. Now, to an even greater degree, his successor confirmed the theory that more activities reaped more adversity toward the U.S. Engineers in Hawaii.

Although some residents would insist that local criticism of Colonel Wyman was responsible for his relief in March 1942, other, more significant reasons lay beneath his replacement as District Engineer and the simultaneous merger of the offices of District and Department Engineers. The trend toward consolidation had already begun with the ferry route program in October 1941, for on this project the Chief of Engineers had ordered the Honolulu District Engineer to place himself at the disposal of the Commanding General of the Hawaiian Department. Further consolidation came just hours after the attack on Pearl Harbor, when Lieutenant Colonel Wyman's office was instructed to assist Colonel Lyman's staff. In order to militarize all construction work in Hawaii because of the war emergency, then, on 28 February 1942 a letter from the Adjutant General's office to the Commanding General of the Hawaiian Department ordered the transfer of all functions of the Honolulu Engineer District except river and harbor and flood control matters to the jurisdiction of the Commanding General, Hawaiian Department. The Engineer officer designated as Department Engineer by the Commanding General of the Hawaiian Department would also be designated as District Engineer by the Chief of Engineers. In effect, that is, Lieutenant General Emmons would choose the Honolulu District Engineer. The date of the consolidation of the two Engineer offices was set for 15 March 1942. On 16 March, all military and civilian personnel, funds, and equipment not exclusively concerned with river and harbor or flood control work were transferred to the office of the Department Engineer, who thus commanded all Engineer construction activities, including fortification construction and maintenance, and all Engineer troop training in Hawaii.

Significantly for the history of the Honolulu Engineer District, the Department Engineer in March 1942 was Colonel Lyman. A "local boy" of Hawaiian ancestry, Colonel Lyman had graduated from Punahou School and had been welcomed back to the islands with great enthusiasm when he became Department Engineer in 1940. His familiarity with Hawaii and his efficient organization of the islands' Engineer forces soon reaffirmed public confidence in the U.S. Engineers. On 11 August 1942 Colonel Lyman became the first officer of part-Hawaiian blood to be nominated for Brigadier General. His sudden death only two days later saddened all Hawaii, which through Colonel Lyman had regained respect for the Engineer units in the islands. At ceremonies at Punahou on 27 November 1942 Mrs. Lyman accepted the Distinguished Service Medal awarded posthumously to her husband.

Colonel Lyman's popularity resulted in part from his personality but also from the gains achieved by the reorganization of 15 March. Some of Colonel Wyman's problems had arisen because of confusion over jurisdiction: although immediately after the

attack of 7 December the District Engineer had been instructed to assist the Department Engineer, Lieutenant General Emmons had sometimes bypassed his Department Engineer in issuing orders to Colonel Wyman. The District Engineer — instead of or in addition to the Department Engineer — at times attended Lieutenant General Emmons' staff conferences. Furthermore, Colonel Wyman was subjected to the often conflicting orders of the various local commands without clearly understanding the point at which these orders should be approved by the Commanding General of the Hawaiian Department. After 15 March 1942, when Colonel Lyman served as both Department and District Engineer, much of this confusion was eliminated. One man was charged with the planning, design, and execution of all Army and Air Force construction in Hawaii and was directly responsible to the Department Commander for the satisfactory completion of that construction. Although Colonel Lyman maintained separate offices for the Engineer District and the Engineer forces of the Hawaiian Department, he commanded both outfits. In case of disagreement between the Department Engineer and the commander of a using service, the Department Commander's decision would prevail.

Thus the reorganization of Hawaii's Engineer forces on 15 March 1942 clarified the relationships among the Territory's Engineer units by appointing the Department Engineer as District Engineer as well. The first of several such consolidation measures undertaken during the war, this course helped transform the Honolulu Engineer District from a civil works force with fortification duties into an agency devoted exclusively to military construction. Although technically the District Engineer remained responsible to the Chief of Engineers for river and harbor and flood control works, by mid-1942 these activities had ceased and the Honolulu District occupied itself with the construction requirements of the war.

From March 1942 to September 1943 the work of the U.S. Engineers in Hawaii focused on military construction within the Hawaiian Islands. This period saw many organizational changes in the District office and a rapid rise in the number of personnel employed by USED. After his death on 13 August 1942, General Lyman was succeeded by Colonel Holland L. Robb, who served temporarily until Brigadier General Hans Kramer arrived in Honolulu on 26 September. Whereas Colonel Lyman had begun his tour in Hawaii as Department Engineer and therefore seemed to emphasize the duties of that office, under Brigadier General Kramer the functions of the District Engineer predominated. Brigadier General Kramer used District Engineer rather than Department Engineer letterheads, and a few days after he assumed office he appointed Colonel Brendon A. Burns as his assistant at Fort Shafter. Former Operations Officer Colonel Benja-

Brigadier General Albert K. B. Lyman, Honolulu District Engineer, March-August 1942.

Brigadier General Hans Kramer, Honolulu District Engineer, 1942-1944.

min R. Wimer acted as "trouble shooter" and Control Officer for the District, while Major Joseph Matson, Jr., took charge of Operations. The staff of the Honolulu Engineer District continued to supervise the design and construction of all Army and Air Force projects in the islands.

One of Brigadier General Kramer's most irksome tasks concerned the termination of the contract with Hawaiian Constructors on 31 January 1943. At that point the Engineers had paid the contractor a fixed fee of $541,031, had bought $625,052 of used equipment from the joint venture, and had paid an additional $124,105 for the rental and recapture of new equipment. Wrangling over final terms continued throughout Brigadier General Kramer's tour until a settlement was reached in May 1944, when both parties agreed upon a total cost of work of $112,031,375, a fixed fee of $1,215,597, and a supplementary fee resulting from Government termination of $1,060,000.

The Engineer District had already assumed some of the contractor's functions, such as timekeeping and payroll preparation, in 1941. Upon termination, then, the U.S. Engineers simply absorbed the entire venture and hired almost all the Hawaiian Constructors employees. In late 1942 approximately 17,000 people worked for the U.S. Engineers and another 7,400 for Hawaiian Constructors; in 1943, after the District had absorbed the contractor's firm, the total number of USED employees rose to an all-time record of 26,000. New divisions within the office reflected this extraordinary growth of the District office. The summer 1943 telephone directory, for instance, listed four field areas, 17 base yards, and two camouflage factories under the U.S. Engineers. Among the new offices established during the first year of Brigadier General Kramer's tour was the Service Division, which included the Safety and Labor Relations Units, the Camps and Messes Division, and, later, special activities such as medical aids and recreation. The Service Division functioned under the supervision of the Executive Officer and at one time managed six camps and eleven cafeterias which housed and fed the construction crews. In May 1943 the Dredging Division was established by District order, and later that year the increasing volume of personal mail received by District employees required the opening of a branch of the U.S. Post Office at Punahou School.

Perhaps most colorful of all the new units in the District was the Engineer Company of the Women's Army Volunteer Corps. Established in November 1942 by women employees of USED and Hawaiian Constructors, this outfit met after work at Punahou three times a week for instruction and marching drills. By March 1943 the group's membership had grown to include 500 women who were divided into four platoons at Punahou and another platoon at Pier 2. After a six week training period, WAVC members could assist the District Engineer by operating telephone exchanges, providing first aid care, or directing evacuation drills.

In order to keep office procedures simple and avoid the frills and confusion which might have

Supply clerks at work at Punahou headquarters of US Engineers during World War II.

Women's Army Volunteer Corps company inspection by General Delos C. Emmons, Brigadier General Hans Kramer, and Mrs. Albert K. B. Lyman, in November 1942.

accompanied the organization of so many new units within the District, on 1 January 1943 Brigadier General Kramer established the Bottleneck Busting Division and assigned his Executive Officer, Colonel Nurse, as Big Bottleneck Buster. By mid-February Colonel Nurse had broken approximately 400 bottlenecks. In August 1943 this section came under the Control Division, from where it continued to locate and remove obstacles so as to improve the District's work. At the same time the District Engineer attempted to consolidate several areas of his office. The Transportation Section of Hawaiian Constructors became the Transportation Subdivision of the District's Operations Division as early as August 1942. Beginning in January 1943, the various field areas, which had been responsible directly to the District Engineer, were to report instead to the Operations Division. Area 2 absorbed Area 10 and Area 5 Incorporated Area 13 in the spring of 1943, while in May project foremen added timekeeping to their duties to save hiring over one hundred men. The termination of the Hawaiian Constructors contract on 31 January 1943 and the consequent employment by the District of the contractor's crews further consolidated the diverse units of the forces under the U.S. Engineers. These reorganizations within USED enabled the District Engineer to carry out the assorted duties assigned to him in this period of the war. Until September 1943 the District's military construction continued to focus on the home front, as the United States still fought a defensive war and the Engineers concentrated on protecting the Hawaiian Islands from invasion or attack.

The heavy workload characteristic of the first three months of the war continued throughout 1942 and 1943; between 15 February and 15 April 1943, Brigadier General Kramer's office received 576 requests for new work and approved all but 101. The expansion of airfield facilities remained the District's most important construction project, and runways on the outer islands of Kauai, Molokai, and Hawaii were paved while storage facilities at several locations were expanded. The installation of utilities became another area of great activity. By December 1942, for example, the Design Division had recommended linking the Hawaiian Electric

Company with the islands' plantations so that the plantations' power might be diverted to Hawaiian Electric in case of an emergency. The tie lines proved quite useful during normal power outages later in the war. Also installed between March 1942 and September 1943 were night lighting facilities at civilian airfields on Kauai, Molokai, Hawaii, and Oahu. This project required extensive coordination between the Engineers and the CAA, various electric companies, the Public Works Office of the 14th Naval District, and local Army Air Corps commands. Telephone exchanges damaged by the attack were rebuilt and splinterproofed in 1942, and in 1943 the District began construction of a camp at Waianae, Oahu, as the first step in an inter-island radio telephone system. Chlorination of water at both military and civilian communities was another project falling under the heading of utilities.

The Engineers continued to maintain the islands' fortifications, meanwhile, and assigned the installation and repair of gun emplacements to the Fortifications Subdivision of the Operations Division. March 1942 witnessed the start of an extensive cold storage building program in the islands. The Design Division developed a self-contained, walk-in, portable reefer box with a capacity of 200 to 300 cubic feet for use in isolated locations. An expanded warehouse construction project began a year later, when the District built large warehouses at Wahiawa and Kapalama. Related pier facilities at Kapalama eventually transformed that reservation into a central supply area for the Army. Nor was road construction neglected. Projects which had been halted by the start of hostilities were resumed in May 1943, and a 1946 news release referred to 240 miles of roads built by the U.S. Engineers in the Territory during the war.

Of the various recreational facilities constructed for troop and officer use during this period, the first and largest was Maluhia. This enlisted men's center at Fort DeRussy housed a dance floor and stage, a beer hall, and even a check room for gas masks. The two-winged recreation hall opened in April 1943 and received a third wing in 1944; the club has continued for over 25 years to serve the Armed Forces in Hawaii. Other recreational facilities built around 1943 included an enlisted men's bath house, a PX, and a beer lanai at Haleiwa on Oahu's north shore, camps at Lanikai and Waikiki, and a recreation center on Maui.

Working under the ground as well as on the surface, the Engineer forces in Hawaii did extensive tunnel construction in 1942 and 1943. The underground gasoline ammunition storage facilities designed by Colonel Wyman were constructed in 1942, while similar tunnels were drilled near Kipapa Gulch in 1943. The Honolulu District believed these facilities at Kipapa were the first steel-lined tunnels ever constructed for storing gasoline. In May 1942 construction began on a bombproof shop for repairing airplanes. Designed to be well camouflaged and protected, the shop was located in a pineapple field southwest of Wheeler Field. Another significant underground project of the District was the Joint Army and Navy Command Post, an expansion of the tunneled operating center already shared by both services in Aliamanu Crater. Drawings for the bombproof command post were completed and construction of the post began in March 1943. Similar facilities were built near Schofield Barracks, near Salt Lake, and at other sites on Oahu. So extensive were the wartime underground activities of the Engineers that in 1945 a District employee estimated that if all the tunnels blasted during the war were placed end to end, the entrance would be at Koko Head and the exit at Moanalua; if all the rock excavated from those tunnels were loaded into railroad cars, 40,000 gondolas would be needed to carry the load.

Thus the Honolulu Engineer District occupied itself until September 1943 with the defense and protection of the islands. In these years the activities of the expanded Engineer office ranged from airfield runway paving to storage tunnel drilling, and all Hawaii became familiar with the apparently ubiquitous USED. Although since September 1942 he had served as both District and Department Engineer, Brigadier General Kramer had maintained separate offices for the two units. In September 1943, however, a second reorganization of Hawaii's Engineer forces resulted in the actual merger of Brigadier General Kramer's two commands and in a gradual shift of emphasis for Oahu's Engineers from defense of the islands to supply for overseas campaigns.

On 1 June 1943 Lieutenant General Robert C. Richardson, Jr., relieved Lieutenant General Emmons as Commanding General of the Hawaiian Department. Two and a half months later, on 14 August, the Hawaiian Department was redesignated as the U.S. Army Forces in the Central Pacific Area (USAFICPA), and in another two weeks, on 1 September 1943, the organizations of the District Engineer and the Department Engineer merged to become the Engineer Office, Central Pacific Area. Thus in a sense the Honolulu Engineer District no longer existed as a separate unit; Brigadier General Kramer, who previously had been both District and Department Engineer, now held the single title of Engineer Officer, CPA. Yet until May 1944 the General kept separate the functions of the two organizations: Colonel Wimer served as Deputy District Engineer, supervised construction in Hawaii, and furnished supplies; while Lieutenant Colonel Desloge Brown acted as Deputy Department Engineer and was engaged principally in offensive planning.

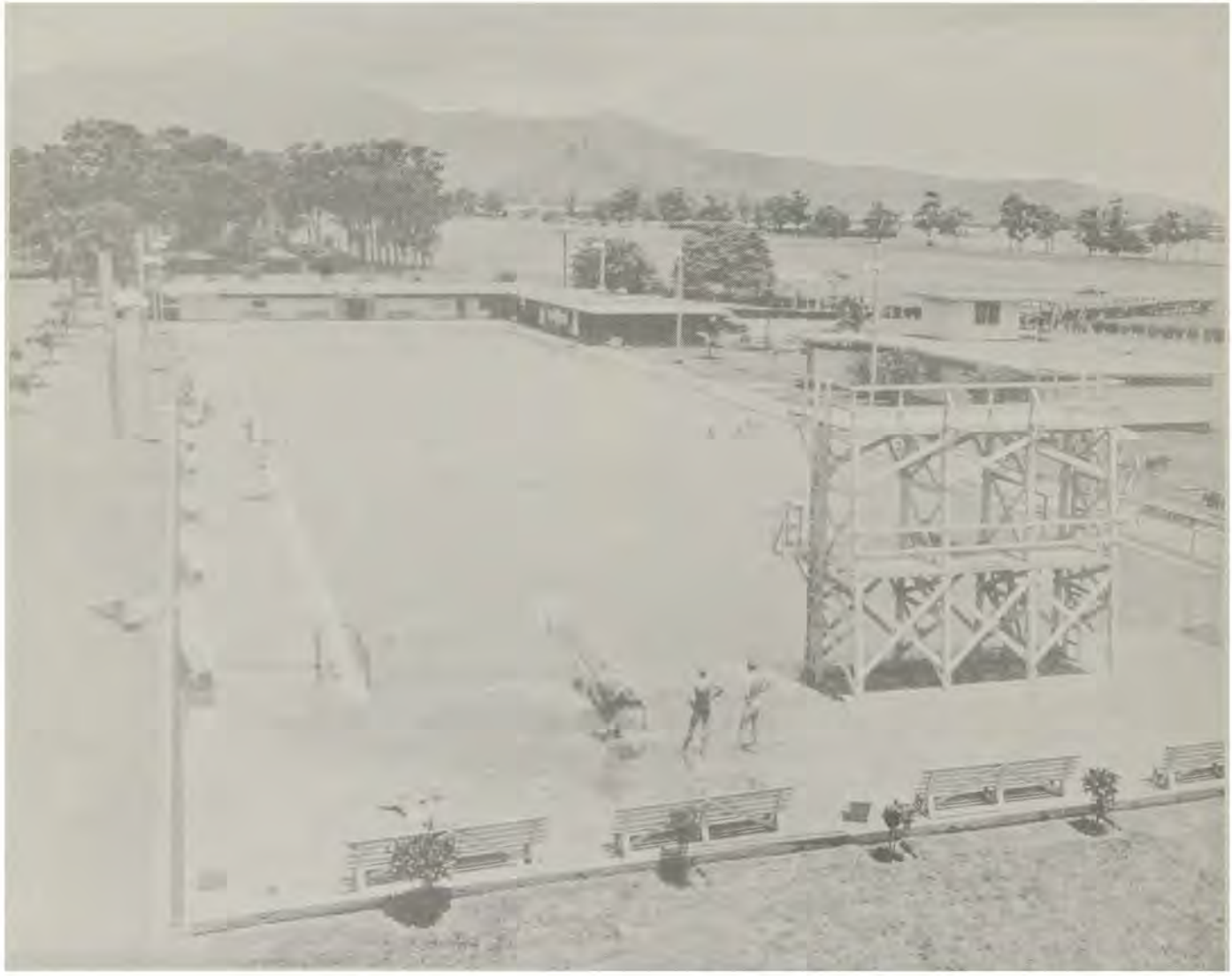
From September 1943 to May 1944, Colonel Wimer's staff continued many of the projects begun in Hawaii during the previous two years. The Engineers built bombproof radio stations at the Waipio and Helemano installations on Oahu, for example. Roads constructed during this period included a net at Mokuleia Air Field, a highway and parking areas at Schofield Barracks, and an access roadway to the

radio station at the top of Mauna Kapu. An olympic-sized swimming pool with a capacity of 1,250,000 gallons was started at Schofield Barracks in August 1943 and completed the following January; intended as a training facility for island soldiers, the pool was used after the war for recreation as well. Training installations such as the jungle camp at Kaaawa and amphibious camps on Maui and Kauai also joined the list of the Engineers' construction activities. Among the buildings erected in this period were an automobile assembly shop, a repair and maintenance shop for B-29 and C-54 planes, and several more warehouses. During April 1944 alone the Engineers provided 491,360 square feet of warehousing and 46,800 cubic feet of refrigerated storage space.

Most important of all the design and construction jobs completed by the Engineers in 1944 was the complex of office buildings built for the Pacific Command and known as the "Pineapple Pentagon." The highest priority was given to this project, for upon its completion the planning staff of CPA could move from its temporary quarters at Punahou to the new building at Fort Shafter. Later named Richardson Hall in honor of the Commanding General, CPA, the Pineapple Pentagon became the Army's nerve center for directing large-scale wartime operations in the Pacific. The three structures comprising the complex occupied a steep site and were irregular in shape in order to minimize excavation. Open but covered passageways connected the four-story redwood buildings. In contrast to much of the construction done earlier in the war, this facility was designed as a permanent structure and today still houses the Headquarters of the U.S. Army, Pacific. The first work order for design and construction was issued in April 1944 and construction began on 10 May; only 48 days later, on 27 June 1944, the first units occupied the new command post at Fort Shafter. Even in their local construction work, the Honolulu Engineers contributed to the war effort overseas.

A more direct contribution was the planning and

Swimming pool built at Schofield Barracks in 1943 and 1944.



Front of Richardson Hall, the "Pineapple Pentagon" constructed by the Honolulu Engineers in 1944.

Side view of Richardson Hall, constructed in 1944, showing the irregular shape of the structures and their location on the site's steep slopes.

furnishing of supplies by USED for the Pacific island assaults. At about the same time that Brigadier General Kramer's two organizations merged into the Engineer Office, CPA, America began to wage a more active battle in the Pacific. This shift from defense to offense subtly redefined the focus of the Honolulu Engineers, who after September 1943 centered their energies around the supply of the forward bases which were to serve as stepping stones for the eventual invasion of Japan. While Colonel Wimer's staff continued the local construction projects described above, his office also furnished the supplies requested by Lieutenant Colonel Brown's War Plans Section, which moved from Fort Shafter to Punahou in August 1943. Both halves of the Engineer Office played important parts in the campaigns for the Gilberts, Marshalls, and Marianas, that is, since the Deputy District Engineer provided the supplies which the Deputy Department Engineer determined necessary.

In accordance with plans formulated by the Joint Chiefs of Staff earlier in 1943, the Gilbert Islands would be captured first, in November of that year. In August 1943, then, Brigadier General Kramer's office began planning for the assault. Lieutenant Colonel Brown's staff estimated the requirements for taking and developing the base; Colonel Wimer's staff supervised the reproduction of intelligence maps, trained troops on Oahu, and furnished the needed material and equipment. Even before the Gilberts fell to the United States on 20 November 1943, similar planning for the capture of the Marshalls had begun. Brigadier General Kramer's office completed layouts for the air base on Kwajalein, prepared detailed lists of available materials, and assembled the construction equipment needed for the Army phase of the assault. Base development in the Marshalls received special attention, and the Mills Division of the Engineer Office expanded in order to manufacture special items such as prefabricated barracks. The United States assaulted the Marshall Islands on 1 February 1944 and began at the same time to plan for the recapture of the Marianas as well. Once again Brigadier General Kramer's staff handled Engineer supply needs. Learning from the experience of the Marshall Island operations, the Engineers ordered most of the construction materials and equipment needed for base development to be shipped directly from the mainland to the Marianas, even though this required submitting requisitions three months before desired delivery. Locally, the machine shop at the Wahiawa base yard developed special parts for the flamethrower tanks to be used in this campaign. The conquest of the Marianas, completed by July 1944, was the largest assault thus far undertaken in the Pacific; for the attack on Saipan alone, plans called for transporting 78,000 men and 100,000 tons of supplies from Hawaii.

Certainly the campaigns for these three Pacific atolls constituted the Honolulu District's most direct contribution to the war. Although in a strict sense only the Deputy District Engineer's office could claim descent from the old Honolulu Engineer District, in this period from September 1943 to June 1944 the District office was combined with the former Department Engineer's office under one commander. Even excluding the supply planning carried out under Lieutenant Colonel Brown, the Engineers' furnishing of materials and equipment, their training of troops, and their reproducing of maps transformed the former civil works agency into a vital cog in the wheel of Allied victory. Just as the District's earlier jobs at Midway and at the South Pacific ferry route sites had provided valuable experience for these overseas campaigns, so in turn the assaults on the Pacific Islands in World War II set the scene for the Honolulu Engineers' return to the Marshall Islands in 1959.

While the United States made final preparations for the assault on the Marianas, in June and July 1944, the Engineer forces on Oahu underwent yet another reorganization. In March 1942 the Department Engineer had assumed the duties of District Engineer; in September 1943 the two offices merged but kept separate their functions; in May 1944 Brigadier General Kramer completely consolidated the two halves of his Engineer Office. Now, on 1 July 1944, CPA's Engineer units were once again divided, this time into an Engineer Section, Central Pacific Area, and an Engineer Section, Central Pacific Base Command. The first of these organizations moved into the new Pineapple Pentagon and from there determined Engineer policy, while the second group remained at Punahou as heirs to the Honolulu Engineer District. One month later, on 1 August 1944, CPA became the U.S. Army Forces, Pacific Ocean Area (USAFPOA) and joined its Engineer Section at Fort Shafter; the new Central Pacific Base Command (CPBC) continued its operations at Punahou as a logistics or support organization of POA. Thus POA and CPBC maintained separate Engineer units after the middle of 1944.

The final step in this reorganization occurred on 10 August, when the Engineer Section of CPBC was designated as the Construction Service (CNS). Colonel Wimer, who had relieved Brigadier General Kramer as Acting District Engineer upon the General's return to the mainland in May, was now assigned as Commanding Officer of the Construction Service, which included in its jurisdiction all the Engineer troops in the islands, a band, and the office of the Honolulu District Engineer. As a major echelon of CPBC, the Construction Service would carry out all the supply functions formerly handled by the Deputy District Engineer's office, troop training, and other construction activities normally assigned to the District office, while under Brigadier General Herbert B. Loper the Engineer Section of POA would handle the duties of the former Deputy Department Engineer's staff. As a result, while from September 1943 to July 1944 Brigadier General Kramer was

responsible for planning as well as furnishing Engineer supplies for forward base operations, his successor, Colonel Wimer, was responsible only for the furnishing of those supplies.

Supply indeed continued to be CNS's greatest job from August 1944 until the end of the war, for the Engineers provided materials, tools, and parts for construction in Hawaii as well as for the assaults and development of the forward Pacific bases. In charge of storing and issuing all construction material and equipment was the Construction Supply Unit of the Supply Division. The Cargo Unit delivered incoming cargo to the base yards, repaired handling equipment, and shipped cargo to overseas bases; the Reclamation Unit reconditioned equipment and material for construction use. Engineer troop units sent their requests for supplies directly to the CNS Engineer Depot, which stored its material and equipment in 17 base yards near Honolulu.

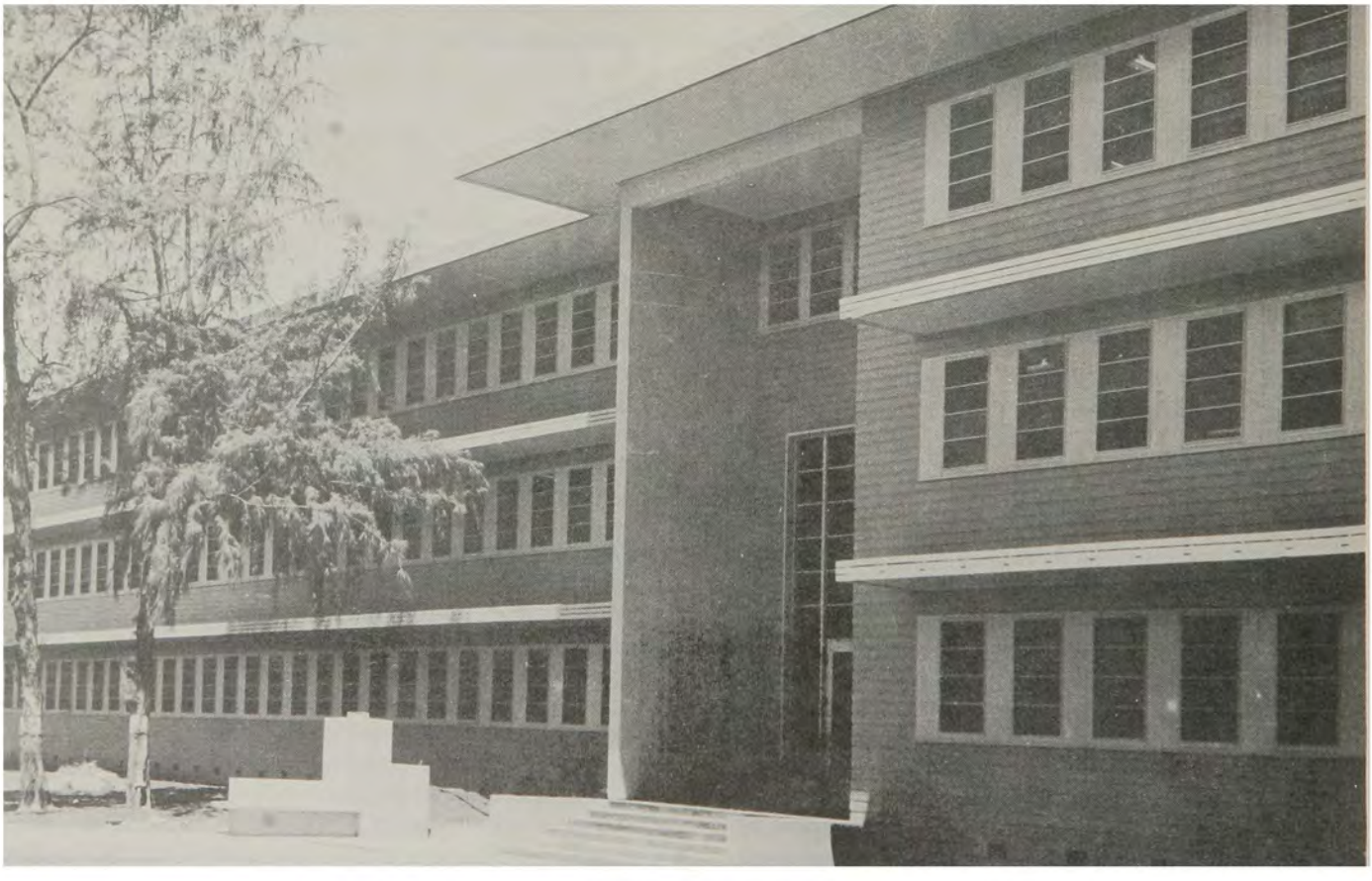
The tremendous volume of supplies handled by CNS created understandable problems. The Army estimated that each man in an amphibious operation required nine tons of supplies and equipment to get him ashore for 30 days; thereafter, a ton a month would suffice. In July 1944 Colonel Wimer observed that two heavy shop companies and two maintenance companies were attempting to meet the needs of 50 battalions of troops and a civilian construction force of 15,000. Shipments from the mainland arrived months after requisitioning, and untrained personnel at some of the base yards had difficulty in identifying parts. The situation improved later in 1944, when a spare parts depot was constructed at Schofield Barracks. Other obstacles were also overcome, so that by August 1945 CNS had furnished the Engineer supplies necessary to capture Iwo Jima and the Ryukyus as well as those needed for wartime construction in Hawaii.

In addition to providing material and equipment for the Engineer troops, CNS was responsible for training the soldiers. Established in May 1944, during the next year the Troop Training Division of CNS planned, organized, and directed the training of Engineer troops for CPBC. This Division operated CPBC schools, which included searchlight and welding classes, arranged billeting for the student soldiers, and even tested water supplies at the various school facilities. Meanwhile, Colonel Wimer's Mapping Section continued to survey, to draw, and to reproduce maps and to distribute copies to Engineer units in the field. Seacoast defenses still remained within the jurisdiction of CNS, as did airfield construction. During 1944 and 1945 the Engineers installed big naval guns from the sunken U.S. warships as part of Oahu's coastal defense system. Despite the time required to manufacture special parts such as gear worms and pinions, by August 1945 the guns at Battery Pennsylvania were ready to fire their test slavo to announce the Japanese surrender. CNS cooperated with CPBC's Ordnance Officer in installing these naval guns. During the same period the Engineers improved airfield pavements at Hickam, John Rodgers, and Barking Sands, and designed and constructed new nose hangars for repair of C-54's. Among CNS's other tasks during the last year of the war was the construction of ordnance shop facilities and an engineer depot at Schofield Barracks. Prisoner of war camps soon dotted the island, while the Engineers considered the construction of the Army Personnel Center at Fort Kamehameha their greatest contribution to "getting the boys back home."

Many of these local construction projects afforded opportunities for CNS to display its ingenuity. The South Sector Repair Shop utilized "junk" in building overhead traveling cranes, for instance, and designed a finger lift attachment with interchangeable parts for moving cargo on landing beaches overseas. By renovating old vehicles, Mills 1 and 3 and Base Yards 6 and 17 constructed a fleet of Red Cross Clubmobiles to bring refreshment and relaxation to the troops in the forward areas. Perhaps the oddest job assigned to Mill 3 was the design and production of a supplemental brace to insure firm spinal support of hospital patients. Equally versatile was Mill 4, which designed and constructed the famous "Jeep Laundry." At his Castle Shop at Punahou, Mr. John W. Mahoney supervised the production of his clever device: baffle plates installed at the bottom and ends of an ordinary oil drum would agitate the clothes in the drum as the barrel seesawed lengthwise. The drum was mounted on a stand made of scrap steel bars and connected by a drive shaft to the right rear wheel of a jeep; the rear end of the jeep was jacked up and the motor was run for twenty minutes, after which the clothes were declared clean. By thus solving overseas laundry problems, the Honolulu Engineers proved their ingenuity in war as well as in peace.

The variety of tasks performed by CNS during the last year of the war necessitated some internal reorganization. For a month after Colonel Wimer left in April 1945, Colonel Robert N. Mutzabaugh acted as District Engineer and Commanding Officer of CNS, and in May 1945 Colonel Claude H. Chorpening assumed both duties. As an example of the changes made within CNS during the last half of 1944, the old Construction Branch became the Operations Division and was assigned the supervision of all construction activities other than those accomplished by the troops. In August 1944, this Division included the Dredging Division, the Tunnel Area, the Mills Division, Field Areas 1, 2, and 3, two Engineer dredge crews, and an Administrative Section. By June 1944 the administrative functions of the Department Engineer's Troop Supply Section and those of the District Engineer's Supply Branch had been consolidated as the new Requirements Section; in December 1944 this unit was given custody of the Top Secret documents formerly assigned to the War Plans Branch of the Engineer Office, CPA. During most of the war the growing Executive Branch had

Rear of main building of HED Headquarters at Fort Armstrong, in 1950.



Front of main building of US Engineers Headquarters at Fort Armstrong, World War II.

absorbed the functions of the old Administrative unit; now, in May 1945, the Administration Branch was reestablished and the Executive Officer returned to his former position as "buffer" for the commanding officer of CNS. Similar organizational changes in other branches of the Construction Service in 1944 and 1945 enabled the Engineers to carry out their assorted duties.

CNS continued to employ record numbers of civilians in 1944 and 1945. Many of the 26,000 workers on the rolls in 1943 had moved with the War Plans Section to the Pineapple Pentagon, so that, although figures after July 1944 seemed to indicate a reduced complement, the February 1945 peak of 12,903 employees still gave CNS the biggest Army payroll in the islands. Between July 1944 and September 1945, 1,679 employees were recruited from the mainland and another 1,903 locally for jobs with CNS. As the war drew to a close the CNS staff began to decline; in September 1945 the Engineers employed 11,208 workers.

The approaching Allied victory also resulted indirectly in the Engineers' move from Punahou School to new, permanent quarters at Fort Armstrong. Although USED had released Pauahi Hall for first and second grade classes in September 1944, Punahou officials continued to press for the Engineers' complete departure. Reduced wartime pressure in early 1945 meant that CNS no longer needed such a sheltered site for its headquarters. The slightly smaller workload also enabled the Engineers to devote some of their design and construction facilities to building an office for themselves.

Fort Armstrong was chosen as the site, then, and a work order was issued in February 1945. By angling the windows on the north side of the third story of the main building and by locating the engineers' drafting desks in that wing, the designers took maximum advantage of the direct sunlight from the north. The 1399th Engineer Construction Battalion performed much of the heavy labor on this project so that civilian employees could remain on other priority jobs. By the beginning of June 1945 the new building was ready; during the following two weeks CNS employees moved gradually to Fort Armstrong. The main wooden, L-shaped, three-story building contained USED's various offices, while a new motor pool at Atkinson Drive and Kapiolani Boulevard was built at the same time to house automobile equipment and personnel formerly scattered among base yards and sedan pools on Oahu. After filling the swampy Atkinson and Kapiolani site with coral, construction workers completed the motor pool in late June 1945. The Dredging Division meanwhile moved its Machine and Repair Shops to new and enlarged facilities on Sand Island, and the Reproduction Plant occupied new quarters at Pier 2A. Thus by July 1945 all the Engineer forces had left Punahou and returned to the vicinity of the Honolulu waterfront.

At the same time, CNS employees began restoring the Punahou campus so that they might return the school in even better condition than they had found it. Tools in the Manual Arts Department had to be replaced; the false floor in Dillingham Hall had to be removed; two 35-foot long tunnel shelters on the grounds had to be filled. At ceremonies on 8 September 1945, Major General Henry T. Burgin, Commander, CPBC, returned the campus to the trustees, and in accepting the premises trustee chairman Walter F. Dillingham expressed great pride in Punahou's contribution to the Allied victory.[9]

Lieutenant Colonel Carl E. Rantzow, Real Estate Officer, Construction Service; Lieutenant Colonel John H. Anderson, Operations Officer, Construction Service; and Colonel Claude H. Chorpening, Engineer, Central Pacific Base Command, inspecting restoration work at Punahou School in 1945 with school officials, Mr. Walter F. Dillingham; Mr. A. G. D. Rust; and Dr. John F. Fox.

The transfer of the Punahou campus from USED to the school's trustees served as an example of the many real estate transactions conducted by the Honolulu District and its heirs during World War II. Originally, the Honolulu Engineer District was responsible only for those real estate functions which related to its river and harbor or fortification activities. Along with the transfer of all Army construction to the Corps of Engineers in December 1941, then, went the District's assignment as real estate agent for the Army in Hawaii. Lieutenant Colonel Charles S. Marek served as the District's first Real Estate Officer; during the war he was succeeded by Lieutenant Colonel Carl E. Rantzow.

For most of World War II, the District's Real Estate Office handled primarily land acquisition. In many cases similar to the Engineers' take-over of Punahou on 8 December 1941, the Army had occupied private property in Hawaii with only a right of entry permit, and by the end of 1943 approximately 2,000 such illegal occupancies awaited processing by the Real Estate Office. Leases formally legalized most of these occupations; whereas prior to December 1941 leases had to pass through the Commanding General of the Hawaiian Department and also through the War Department in Washington, once the war began most leases were prepared locally and approved by the Commanding Officer of the major echelon involved. Between 7 December 1941 and 15 September 1945 the Real Estate Office executed 1,663 leases, with a total annual rental of over $4 million. Most of these leases would expire six months after the termination of the war. Other properties, primarily airfields and airfield improvements, were acquired outright by fee. In October 1943 Lieutenant General Richardson recommended 25 projects for fee acquisition rather than lease, because of their permanent military value, and later in the war another 15 sites were likewise approved for purchase.

The Real Estate Office continued to acquire land by lease, by permit, or in fee throughout the entire war and by 14 August 1945 had occupied over 210,000 acres in the Territory. In 1943, meanwhile, the Army began to return or restore some of the property occupied earlier, and the Real Estate Office found itself concerned with disposal as well as acquisition. One of the first pieces of property to be returned was the Pleasanton Hotel, which had been leased by Hawaiian Constructors and then USED as living quarters for Engineer employees. On 27 December 1942 the Army transferred the hotel to its former owners. The following summer saw the return of all of Stevenson School, one wing of Leilehua School, and two classrooms at Maemae School for fall term classes. Also representative of the wartime real estate disposal program was the return in early 1945 of several private gas stations which USED had been using since December 1941 to service Army vehicles. Of the 1,663 leases executed during the war, 774 were terminated by 15 September 1945, and approximately $950,000 had been paid to the sugar and pineapple companies by then for crop damages during the war. Thus land disposal and restoration as well as land acquisition characterized the work of the Real Estate Office during World War II. During the next decade the Army would return and restore even more property in Hawaii and the Honolulu District's Real Estate Office would continue its active pace.

Although the preceding accounts of military construction and real estate activities during World War II might suggest that the Honolulu District had surrendered its original civil works functions, in reality the Engineers remained busy between 1941 and 1945 with defense-related dredging. To be sure, civil works activity almost disappeared, for American entry into the war meant the suspension of all the District's authorized projects not directly connected with defense efforts. Thus funds allotted to the Honolulu District for river and harbor and flood control work between January 1941 and December 1944 amounted to only $4 million, while military expenditures by the District during the same period totaled over $226.2 million. Yet some of those military funds were expended on navigation projects which had been authorized before the war and were considered important for wartime defense, and other military appropriations were used for dredging and filling operations on jobs officially labeled as military construction. Though not designated as harbor development, that is, defense-related dredging did utilize some of the District's talents during the war.

Under normal circumstances the Honolulu District owned no dredges of its own but borrowed plant for short periods of time from Engineer districts on the west coast. The exigencies of World War II, however, resulted in the temporary acquisition by the Honolulu Engineers of considerable floating plant, including five seagoing hopper dredges, four electric cutterhead pipeline dredges, three steam cutterhead pipeline dredges, five steam clamshell dredges, one diesel clamshell dredge, one steam dipper dredge, one diesel-electric walking dragline, one floating power plant, two booster pump barges, and one drill barge. Dredging personnel estimated that during the war almost half of this plant equipment operated in the South Pacific in connection with the ferry route program and the later development of forward bases in the Marianas and the Ryukyus. In 1942 and 1943, 905,054 cubic yards were dredged at Canton and another 337,789 cubic yards at Christmas Island, as a 1,000-foot turning basin at each site was dredged to a depth of 26 feet. In 1944 and 1945, over seven million cubic yards were excavated at Guam and a total of over 1.4 million cubic yards at Saipan and Tinian.

Oahu as well as the South Pacific islands saw dredging activity by the Honolulu District during the war. Established in May 1943, the Dredging Division was headed during the next two years by Major George Wiles, Lieutenand Colonel John J. Kestly, and then Mr. Alfred O. Strandberg. In addition to repairing its own plant and carrying out routine maintenance at Hawaii's deep-draft harbors, this division constructed a crash boat base at Haleiwa, built a dredge repair basin adjacent to Sand Island, repaired six piers at Honolulu, and excavated 190,830 cubic yards from Kewalo Basin. During the war amphibious training facilities were constructed at Pokai Bay and Waimanalo on Oahu and at harbors on Maui and Kauai. Of special interest to local residents was the project which filled part of a low area bounded by Ala Moana and Kapiolani Boulevards, Piikoi Street, and Atkinson Drive; today this site houses Ala Moana Center, one of the largest shopping complexes in the world.

Even more important than these various dredging and filling jobs, however, were the District's wartime projects at Keehi Lagoon and Honolulu Harbor. Consideration of the Keehi Lagoon seaplane runway project began as early as 1936, when Pan American's clipper planes first landed in Hawaii. As at Midway, both commerce and defense called for the establishment of a seaplane harbor; although the Navy allowed Pan American to use Pearl Harbor, an emergency requiring the use of that harbor would halt all flights. Furthermore, no foreign clippers could land in a basin operated by the U.S. Navy. In December 1936 Lieutenant Colonel Crawford suggested using emergency PWA funds to dredge a seaplane harbor at Keehi, the shallow indentation between Pearl and Honolulu Harbors, and the River and Harbor Act of 26 August 1937, which authorized the Midway project, called for the investigation of a similar seaplane harbor at Keehi Lagoon.

Wind studies constituted an important part of the extensive surveys carried out by Major Bermel during the next three years. In 1939 the District Engineer recommended the $3.3 million construction of three intersecting runways, each to be dredged to 1,000 feet wide and 10 feet deep. Runway A, to be 2.9 miles long extending SW / NE, in the direction of the prevailing winds, would be used 80 per cent of the time. The 3.0-mile long Runway B would extend in an E / W direction and would be used during winds of less than 10 miles per hour, while Runway C would extend for 1.4 miles in a NW to SE direction. Two breakwaters at the seaward end of the runways would stop wave action and thus protect the harbor. The project as authorized by the National Defense River and Harbor Act of 17 October 1940 provided for the three runways and two breakwaters as well as for a mooring basin 800 feet long by 400 feet wide and 10 feet deep at the northwest side of Runway A. Also included in the project was the installation of a standard seaplane lighting system.

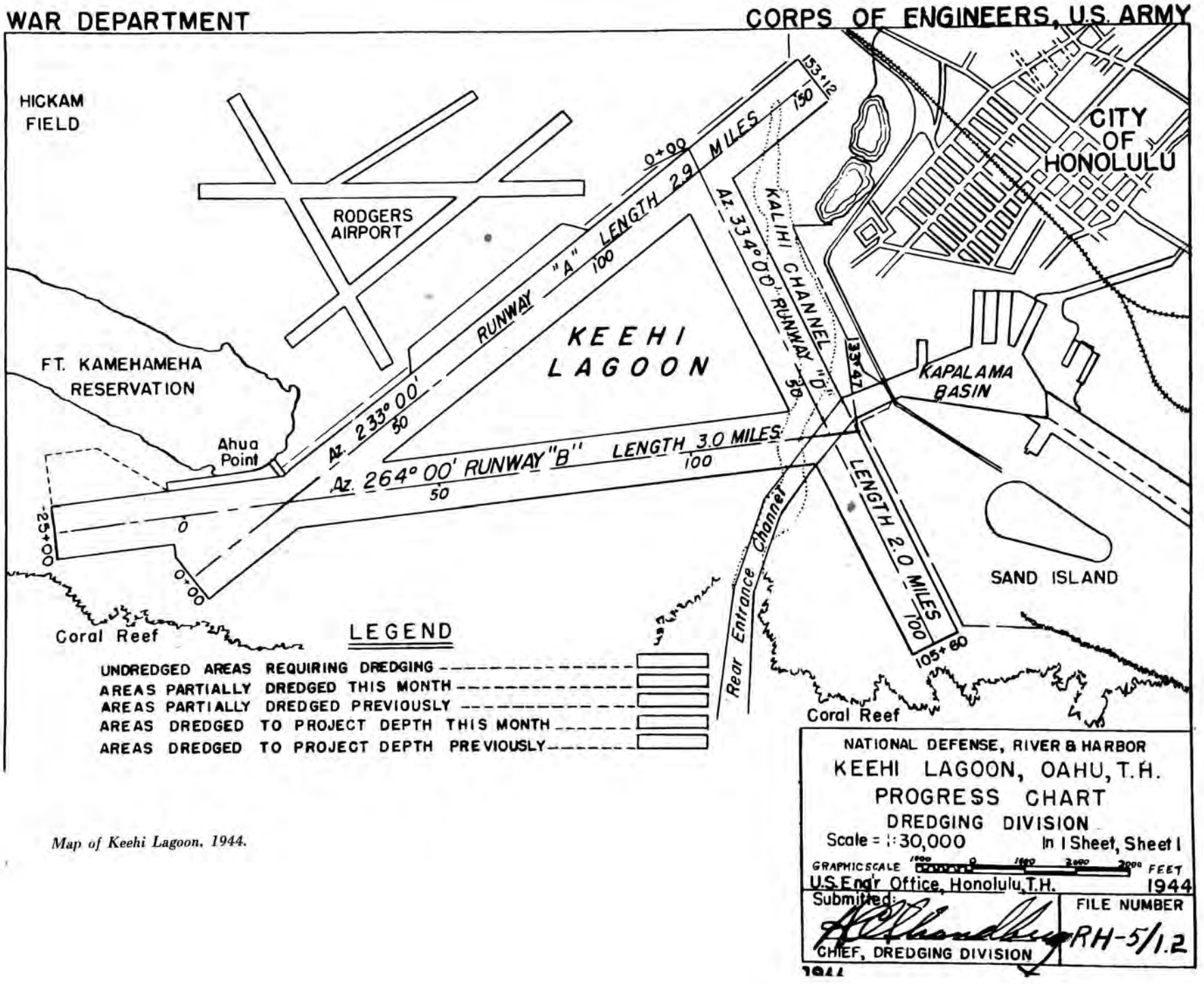
In May 1941 the House Committee on Rivers and Harbors ordered a reexamination of the Keehi Lagoon project with a view toward possible modification. At the suggestion of the CAA, the Engineers decided to substitute for Runway C a Runway D, located 6,600 feet east of C, to be 2.25 miles long, so that planes would not have to land and take off over the congested area of John Rodgers Field. This change was later included as a project modification by the River and Harbor Act of 2 March 1945. Meanwhile, in May 1941 Congress authorized the development of the John Rodgers Airport, a civilian facility to be located east of Hickam Field. Meetings with CAA, Federal, Territorial, Pan American, and Inter-Island Airways representatives resulted in the logical consolidation of the seaplane harbor and the adjacent airport projects. Material dredged from the harbor would be placed on the sites of the proposed land runways at John Rodgers, while military, CAA, and regular civil works funds would finance the joint project.

Construction of the seaplane runways at Keehi Lagoon began by contract in October 1941. Upon American entry into the war, then, completion of the runways was given high priority, the project was reassigned to hired labor, and Government plant moved to the site. As a wartime measure during construction, the mooring basin was enlarged to 500 feet wide and 3,000 feet long, while construction of the 4,500-foot breakwater was abandoned as unnecessary. By the time operations ceased at the end of the war, the Engineers had packed the coral fill at the airport site to an average height of eight feet above low water level and thus literally laid the foundations for the future development of Honolulu International Airport. The Keehi Lagoon project was completed in September 1944 and the three seaplane runways were transferred to the Commandant of the Honolulu Naval Air Station in November 1944.

Of the total cost of approximately $3.3 million, military funds absorbed the $2,033,686 expended on the construction of Runways A and B, while CAA funds of $1,269,192 covered the cost of Runway D. Like the project at Midway, which had served as precedent for this seaplane harbor, the Keehi Lagoon project resulted from both commercial and defense requirements, and the runways were rushed to completion because of a military rather than a commercial emergency. Even the final funding of the three runways reflected the varied reasons for the authorization of the project and demonstrated once again that the history of the Honolulu District has followed that of the world.

The Keehi Lagoon seaplane harbor project was one of the major wartime dredging activities carried out with military funds. Soon after the war ended, land-based aircraft replaced the old clipper planes and gradually made the seaplane runways at Keehi obsolete; the 1965 River and Harbor Act authorized the abandonment of the project. More significant for the later commercial development of Honolulu Harbor were two other navigation projects developed during the war: the enlargement of Kapalama Basin and the Reserved Channel, and the initial dredging of the Kalihi entrance to the harbor.

Earlier eras had witnessed the gradual westward growth of Honolulu Harbor, and local interests as well as USED assumed that further development at Honolulu would focus on Kapalama Basin and the Reserved Channel which linked the basin to the main harbor. Although the River and Harbor Act of 30 August 1935 had authorized the maintenance of the Reserved Channel over a width of 400 feet throughout its 3,000-foot length, a 1,000-foot portion of the channel actually extended over a width of 800 feet. As the war approached, then, the Fifth Supplemental National Defense Appropriation Act allotted $792,100 to the Honolulu District Engineer for dredging slips and a turning basin 35 feet deep, 1,600 feet wide, and 2,000 feet long in Kapalama. Also authorized by this act were two Army piers to be constructed by the Quartermaster in Kapalama Basin.



Map of Keehi Lagoon, 1944.

Lieutenant Colonel Wyman's report of 20 August 1941 noted that these improvements would require the widening of the Reserved Channel as well, to provide access from Honolulu Harbor to the new Kapalama facilities. At the request of the Commanding General of the Hawaiian Department and as a military measure of national defense, then, work began in September 1941 to enlarge both Kapalama Basin and the Reserved Channel at an estimated cost of $1.4 million in addition to the Defense Act appropriation.

Called into service for this project was the dredge **S.G. Hindes**, which arrived in Honolulu in the fall of 1941. With the outbreak of war, priority was given to the completion of the runways at Keehi Lagoon, and the dredge did not return to Kapalama until the following July. The **Hindes** left the basin area again in February 1943 and returned in January 1945 to finish the project by that August. The dredging done during the war included a turning area 1,000 feet wide and 3,000 feet long in Kapalama Basin; the strip dredged to 200 feet wide and 2,600 feet long on the southerly side of the Reserved Channel meanwhile widened the channel over that length to 600 feet. Both of these areas were excavated to a depth of 35 feet. In addition, as heirs to the Quartermaster's Army construction program, the Engineers completed a variety of terminal facilities at Kapalama between 1941 and 1945. The previously authorized piers, 39 and 40, were built as 1,000-foot long mole type structures, and a 4,000-foot long timber pile wharf was constructed on the south shore of the channel. A slip 200 feet by 500 feet and 30 feet deep on the north side of Kapalama Basin adjoined the marginal wharf for small vessels. The 250-foot by 750-foot dredge marine repair slip on Sand Island was also included as part of the Kapalama project, as was a concrete sheet pile barge mooring wharf 470 feet long located shoreward of Pier 39.

In order to house many of these wharves and piers, enough of the 4.5 million cubic yards of material dredged from Kapalama Basin and the Reserved Channel was placed on Sand Island to double its acreage. Providing additional terminal facilities had been the motivation for much of the earlier work at Honolulu and certainly for the harbor's westward expansion along the Reserved Channel. Now, as a result of the dredging at Kapalama, not only that basin but also the north shore of Sand Island might serve as the site for further terminal improvements by the Territory or by private interests. Dredged material from Kapalama was also pumped two miles to the lowlands at Fort Shafter, at the request of the Commanding General of the Hawaiian Department. Today this area, adjacent to Kamehameha Highway and known as Shafter Flats, houses one of Honolulu's growing industrial parks.

The work carried out during the war at Kapalama Basin and the Reserved Channel was incorporated in the District's existing project at Honolulu Harbor by the River and Harbor Act of 24 July 1946, which authorized a depth of 35 feet over the full width of 600 feet throughout the Reserved Channel; a turning basin in Kapalama Basin 35 feet deep, 1,000 feet wide, and 3,000 feet long; and a slip also 35 feet deep and 1,000 feet long on the easterly side of Pier 39. The war's approach had resulted in the allotment of defense funds for this project, while the attack on Pearl Harbor had directly influenced the pace of construction by shifting priorities to the runways at Keehi. Closely related to this westward extension of Honolulu Harbor and also prompted by the war emergency was the dredging of the rear or Kalihi entrance channel.

Previous chapters have traced the development of the second Honolulu entrance channel from its first consideration in 1913 to the project's most recent unfavorable recommendation in 1933. Even in the 1940's, the District Engineer agreed that the needs of commerce did not justify a rear entrance channel. Now that America had joined the World War, however, USED perceived that the needs of defense might very well warrant a second entrance, which would provide an alternate access to Kapalama Basin, whose dredging had begun in September 1941. On 1 February 1943, then, Brigadier General Kramer proposed to Lieutenant General Emmons that military construction funds be expended on the excavation of a rear entrance channel, and on the following day Lieutenant General Emmons authorized the project as a military necessity. Approval also came from the Chief of Engineers. The channel was to be 10,000 feet long and 35 feet deep, with a width tapering from 1,000 feet at the seaward end to 400 feet in a distance of 4,000 feet and then continuing at a width of 400 feet to Kapalama Basin.

The project also called for a pontoon bridge to be constructed between Sand Island and the port area at Kapalama. The Navy dredge **Marshall Harris** began excavation of the second channel on 15 February but sank in 30 feet of water on 3 April. The **Holland** and other Government dredges continued the project in August 1943 and during the next two years removed over two million cubic yards of material. Since the end of the war eliminated the emergency which had justified the dredging of the channel, an order from the Commanding General, U.S. Army Forces, Middle Pacific, on 15 August 1945, cancelled the remainder of the project. Over $1 million in military construction funds had been expended on the dredging of the second entrance channel.

Although the defense requirements of the war years took precedence over civil works activities, then, dredging and filling operations still constituted a significant portion of the District's wartime workload. A total of 62,925,039 cubic yards was dredged from USED's projects in the Pacific theater during World War II, while in May 1945 near Sand Island the U.S. dredge **Jefferson** reportedly became the first dredge in the Corps to pump over a million cubic yards of rock in one month. Almost all of this dredg-

ing was related to the national defense program, of course, although each of the three projects near Honolulu Harbor was unique in its civil-military background. The seaplane runways at Keehi Lagoon had been authorized as a civil works project but were rushed to completion as a defense measure with military funds. Conversely, the basin at Kapalama and the widened Reserved Channel were begun as defense measures with a National Defense appropriation but were also financed by regular funds and were incorporated into the District's Civil works program after the war. The dredging of the second entrance channel to Honolulu Harbor belonged in yet another category, for this activity was authorized only as a military necessity, was funded only by military appropriations, and was abandoned after the war rather than incorporated as a civil works project. Whatever its particular combination of civil and military origins, each of these major dredging operations contributed to the defense program of the Honolulu District.

The treatment of the District's dredging projects as a separate project should not obscure the fact that their construction was carried on concurrently with the Engineers' other wartime activities. Several of the dredging jobs related directly to other USED projects: the Engineers placed coral fill for overseas airfields, for instance, and even employed their dredging plant in excavating footings at the new Tripler Hospital site. In this manner dredging operations joined the wide range of the District's wartime activities.

During these years, the Engineers' reach extended from their headquarters at Punahou through 18 field areas and 25 base yards to touch on airfield paving and tunnel drilling, the supply of forward bases, and the camouflage of Oahu's landmarks. In carrying out their assorted duties, District employees naturally came into contact with much of Hawaii's population. The sugar workers hired through the Plantation Agreement, the owners and patrons of service stations commandeered by the Engineers, the students, faculty, and alumni of Punahou and other "occupied" schools — all these found cause to criticize the Honolulu Engineers.

Some of this criticism arose merely because HED became involved in many areas of the community, that is, for ubiquity seemed to breed contempt. A fair share might also be attributed to the establishment of martial law, which was not terminated until 24 October 1944, long after most residents believed its imposition necessary. As a force of the U.S. Army, USED absorbed much of the criticism aimed at the military in general. Yet the Honolulu Engineers seemed to suffer more censure than many other military departments in the Territory. A local resident wrote in January 1943, for instance, "The Engineers have long since alienated the affections of this city by their arrogance and total disregard of every interest except their own."[10] District Engineer at the time of the attack on Pearl Harbor, Colonel Wyman may have been responsible for some of the criticism leveled at HED, for his abrupt occupation of Punahou and his brusque manner seem to have antagonized many citizens with whom he came into contact. Furthermore, by the end of the war even those residents who had not personally met Colonel Wyman had heard of a number of government investigations of the District Engineer. Although these inquiries probed Colonel Wyman's behavior and not the District itself, local interests easily associated the man with the office and came to question all of USED.

One of the earliest investigations of Colonel Wyman's activities concerned the stockpiling of construction materials and supplies at the Albany Race Track in Oakland, California, in late 1941 and early 1942. Recently authorized to create such stockpiles without earmarking the supplies for a particular project, on 29 December 1941 the District Engineer ordered a large amount of heavy equipment through the Division Engineer at San Francisco for eventual delivery overseas. Shipping delays resulted in a surplus, then, and in the spring of 1942 Senator Harry Truman's Special Committee Investigating the National Defense Program asked for a list of the specific contracts and projects for which this stockpiled material was destined. The Senators apparently accepted the District's explanation that since all construction work was being performed under one contract with Hawaiian Constructors no one could identify the exact projects for which the tractors, air compressors, and other pieces of equipment might be intended.[11] In fact, most of the Engineers considered Colonel Wyman's move a wise one; his foresight just weeks after the Japanese attack helped relieve future shortages of equipment on the South Pacific islands. His decision to ship some material directly from San Francisco to those islands also brought approval rather than censure from his staff, and by the fall of 1942 apparently even the Committee had dismissed the issue. Yet news of the inquiry leaked out to the public, who chose to remember only that Colonel Wyman had been criticized for inefficient hoarding of construction supplies.

Even more important than this inquiry was the investigation into Colonel Wyman's relations with Hawaiian Constructors and, in particular, with Mr. Hans Rohl, Rohl-Connolly's President and a German citizen at the time of the signing of the defense contract. Preliminary probes in 1943 set the scene for the Congressional Investigation of the Pearl Harbor Attack, whose Army Pearl Harbor Board heard testimony in September 1944 on the relationship between Colonel Wyman and Mr. Rohl.[12]

Of prime concern to the Board were two issues: the conditions under which the company headed by the alien Hans Rohl had been awarded contract no. 602; and, secondly, the extent to which the slow progress of the aircraft warning station program in 1941 might have contributed to the enemy attack on Oahu. The more direct version of this second issue

suggested that persons connected with the AWS system might have intentionally delayed its construction. On this count both Colonel Wyman and Mr. Rohl were exonerated, for the Board found no evidence to indicate a deliberate attempt to delay. The conduct of the District Engineer was thus eliminated as a casual factor in the Pearl Harbor attack.[13]

To determine whether certain individuals or situations had contributed to the attack was, after all, the major mission of the Board. In so determining, however, the investigators brought out related issues which bore on Colonel Wyman's behavior before and during the war. On the question of Hans Rohl's alien status, for instance, the Board concluded that, contrary to the District Engineer's testimony, Colonel Wyman had indeed known at the time of the contract negotiations that Rohl was a German citizen. Furthermore, the investigation of the contract negotiations led to evidence that the District Engineer had displayed favoritism in awarding the contract to Hawaiian Constructors. The fact that two local firms associated themselves with the joint venture in 1941 and 1942 cast doubt on Colonel Wyman's claim that no Honolulu companies would or could accept the work, while the District Engineer's earlier friendship with Rohl seemed to explain the tremendous increases in the fixed fee paid to Hawaiian Constructors.[14]

In an almost chain-like pattern, then, these charges uncovered still other examples of an "irregular relationship" between Colonel Wyman and Mr. Rohl. New wartime work had been assigned to Hawaiian Constructors even when lower bids had been submitted by other firms; equipment had been purchased by the District from Rohl-Connolly at inflated prices; Rohl's yacht, the **Vega**, had been leased for USED's use in the South Pacific but never sailed past Honolulu Harbor.[15] These disclosures led in turn to new revelations of Colonel Wyman's boisterous behavior. Also brought out in the hearings was the general inefficiency of the Honolulu Engineers under Colonel Wyman. Witnesses testified that construction of the Kahuku airfield lagged because of poor administration, that the District's payroll confused operations, and that almost two-thirds of the mainland employees brought to Hawaii by the contractor lacked essential experience.[16] On this issue of inefficiency the Board agreed, stating that Colonel Wyman "was most inefficient in the handling of his office and in administrative matters, which indirectly caused delays." Hawaiian Constructors was likewise cited by the Board for its "loose and inefficient organization." And the investigation criticized officials in Washington for not correcting the Honolulu District's faults.[17]

Even though the Board found that Colonel Wyman had not contributed to the attack on Pearl Harbor, then, the investigations disclosed evidence of the District Engineer's unorthodox behavior, favoritism in the contract award, and general inefficiency. The public tended to overlook the primary charge of which Colonel Wyman had been cleared and focused instead on the testimony and conclusions which supported earlier opinions of the District Engineer. The Board's findings, that is, reinforced and perpetuated local distrust of Colonel Wyman and his U.S. Engineers.

Yet Colonel Wyman was not solely responsible for the District's public image during the war, for problems continued to arise long after his tour. In January 1943, for example, residents of the Wilhelmina Rise section of Honolulu complained to Brigadier General Kramer, to Lieutenant General Emmons, and finally to Governor Ingram M. Stainback that Engineer blasting in nearby Palolo Valley made their homes "shake like a leaf." A blast on 14 January had reportedly chipped plaster, shaken open cupboards, and upset containers in the refrigerator of one resident, who protested to Lieutenant General Emmons that the Engineers were not operating the quarry efficiently. Brigadier General Kramer coupled his apologies with a reminder that the war's construction program called for considerably more rock than prewar projects had demanded. Local residents appeared satisfied with his explanation and apology but continued to complain about the noisy, ubiquitous Engineers.[18]

In the last few months of the war local distrust focused on the Engineers' prolonged occupation of various Oahu facilities. As late as April 1945, for instance, USED still used McKinley High School sports fields for a warehouse depot. And, asked the island's citizens, wasn't it about time the Engineers left Punahou? School alumni vainly protested the lease signed in 1944 which extended the Engineer's occupancy automatically until "the termination of the existing emergency."[19] Nor did Punahou's anger subside with USED's move to Fort Armstrong, for the loss to the classes of '43, '44, and '45 could not be reversed. The discovery in 1946 that a koa desk at Fort Armstrong bore a Punahou inscription added fuel to the fiery accusations of Engineer disregard for school interests.

To be sure, many criticisms of USED were justified. Perhaps Colonel Wyman could have toned down his abrupt manner and behaved more decorously; perhaps the Engineers could have left the koa desk at Punahou. On the other hand, many of the accusations were excessively harsh, for USED could not have carried out its wartime mission without extending its reach over most of Oahu. Even the Army Pearl Harbor Board realized that certain problems were inherent in the District's sudden transition from a civil works activity to an agency responsible for all Army construction in a vital theater of operations. The Board's report noted that "the peacetime organization and conduct of the Corps of Engineer's construction activities, together with the red tape involved in staff procedure, priorities, and procurement, were such as made delay practically inevitable."[20] USED suffered from a

simple case of growing pains.

Furthermore, although some local residents might choose to recall the Board's judgment of Colonel Wyman, others recognized the District Engineer's accomplishments. As he left Hawaii in March 1942, Colonel Wyman received this letter of commendation from Lieutenant General Emmons:

> Dear Colonel Wyman:
>
> On the occasion of your relief as District Engineer, Honolulu, and from further duty in this Department, I want to express to you my appreciation of the work which you have done for this Department. Many of the projects under your office were initiated prior to my arrival. The most important single one was opened for use after I arrived, and I am very familiar with the problems which you had to solve in accomplishing this work. The fact that this air route was done at all is remarkable; under peace-time conditions it would have been a very difficult job. Its completion and opening for air traffic under war-time difficulties just 78 days after orders to proceed were received and almost three weeks before the date which you had set yourself is outstanding. The accomplishment of this job required force and initiative of the highest degree, and these same qualities were also required for the excellent progress which has been made on the other projects prosecuted under your direction. I am writing this letter to express my official appreciation of your work. A copy of it is being forwarded to the Chief of Engineers, through the Division Engineer, for your official records.
>
> With best wishes for the future,
>
> Very sincerely yours,
> Delos C. Emmons,
> Lieutenant General, U.S.
> Army, Commanding.[21]

Later in the war Colonel Wyman received the Distinguished Service Medal for his services in Hawaii and still later was awarded the Legion of Merit for work carried out in Europe. The District Engineer had successfully strengthened Hawaii's defense posture during one of the most critical periods in the history of the nation. Colonel Wyman's employees as well as his commanding officers recognized the difficulties faced by the Engineers and credited the District with significant accomplishments. An Engineer worker described the situation for an investigating committee:

> We had airfields to build, we had ammunition storage to build, war storage for gasoline on five different islands. Every damn thing was important, and one job would be hot today and probably another job hotter tomorrow, depending upon the using agency putting pressure on a certain job. Consequently, there was a certain amount of . . . fumbling of the ball. . . . We were trying to do three years' work in one year, under difficult circumstances, and I think everybody did their darndest.[22]

Indeed, for the U.S. Engineers to accomplish all that they did during World War II, everyone had to "do his darndest." Never before and never again did the workload of the Honolulu District approach its wartime level. Between 1941 and 1945 Engineer expenditures on construction alone came to $250,000,000; an additional $7,000,000 in CAA funds and another $8,000,000 in contracts with local firms brought the total cost of the wartime Engineer program in Hawaii to $400,000,000. During the war the Honolulu Engineer District and its successor activities occupied over 210,000 acres of private land, received approximately 1,100,000 tons of equipment, and reproduced literally millions of maps for the various Pacific island campaigns. The 1930's had seen the District branch out into new areas such as PWA and WPA administration and studies of lava flow barriers, but even that busy decade now seemed calm compared to the bustling activity of the war years. Construction as varied as gasoline storage tunnels, dredge repair slips, and the Pineapple Pentagon occupied the District's talents; the false floor installed in Dillingham Hall, the Jeep Laundry devised by Mill 4, and the batteries constructed for the USS Arizona's big guns were among the more unusual products of Engineer activity during the war. Probably no other period in the Honolulu Engineer's history exemplified so well the variety of the District's work.

Nor did any other period prompt such a definite shift in emphasis for the Honolulu District. Until World War II, the Honolulu Engineer District was primarily a civil works agency whose major fortification duties remained limited to seacoast defenses. Even the construction connected with the accelerated defense program of 1940 was considered an addition to the District's activities rather than a permanent assignment. The transfer in 1941 first of Air Corps and then of all Army construction to the U.S. Engineers, however, enlarged the scope of the District's responsibilites. Furthermore, because Hawaii played such an important role in the Second World War and because Oahu has continued to host so many Army and Air Force installations, from World War II to the present day military construction projects have occupied more of the Honolulu Engineer's energies and funds than have civil works. World War II represented a significant turning point in the history of the Honolulu District.

Footnotes — Chapter VI

1. Norris Whitfield Potter, **The Punahou Story** (Palo Alto, 1969), p. 68.
2. **Ibid.**, pp. 62, 67-68.
3. **Ibid.**, pp. 69-70.

4. Gwenfread Allen, **Hawaii's War Years: 1941-1945** (Honolulu, 1950), p. 234.
5. Lorrin P. Thurston, "A Tribute to a Driving, Work Producing Genius," The **Honolulu Advertiser**, 26 February 1942, editorial page, col. 3.
6. Allen, p. 237.
7. **Ibid.**, p. 237.
8. Karl C. Dod, **United States Army in World War II: The Technical Services: The Corps of Engineers: The War against Japan** (Washington, 1966), p. 359.
9. Construction Service, Central Pacific Base Command, **CNS Review**, 22 September 1945, p. 1.
10. W.R. Starr to Lt.Gen. Delos C. Emmons, 15 January 1943, in correspondence between Governors of the Territory and State of Hawaii and U.S. Engineers.
11. U.S. Army Forces, Middle Pacific, **Historical Record of Engineer Activities in Middle Pacific Area from 7 December 1941 to 2 September 1945** (Honolulu, 1945), pp. 821-22, 834-48.
12. U.S. Congress, **Hearings before the Joint Committee on the Investigation of the Pearl Harbor Attack**, 79th Cong., 1st sess (Washington, 1946), parts 28-30, 39.
13. **Ibid.**, part 39, p. 177.
14. **Ibid.**, part 39, pp. 146-170.
15. **Ibid.**, part 27, p. 681, and part 29, pp. 1751-52.
16. **Ibid.**, part 28, pp. 1315-36, and part 39, pp. 153-155.
17. **Ibid.**, part 39, p. 177.
18. Correspondence between Governors of the Territory and State of Hawaii and U.S. Engineers, file of Governor Stainback.
19. The **Honolulu Star-Bulletin**, 7 August 1944, p. 5, col. 4.
20. U.S. Congress, **Hearings before the Joint Committee on the Investigation of the Pearl Harbor Attack**, 79th Cong., 1st sess (Washington, 1946), part 39, p. 177.
21. **Ibid.**, part 29, p. 1742.
22. Allen, p. 235.

CHAPTER VII: Postwar Slowdown

After the high pitch of activity of World War II, the pace of the postwar era seemed slow. Although several projects begun during the war continued to occupy the Honolulu Engineers well into the late 1940's, by the end of that decade the District's workload and staff had shrunk considerably and in 1950 the office was redesignated as an Engineer Area. Yet even in these relatively calm years, the Honolulu District displayed a wide variety of talents. Real estate remained an important activity, while the Tripler Hospital and Punchbowl Cemetery projects introduced the Engineers to new fields in the area of military construction. With the resumption of civil works activities, too, new flood control plans and repairs to the tsunami-damaged breakwaters at Hilo and Kahului expanded the scope of the District's work between 1945 and 1950.

The first few months of the postwar period saw several organizational changes occur within USED. On 1 July 1945 USAFPOA had been redesignated as U.S. Army Forces, Middle Pacific (USAFMIDPAC), and on 1 November of that year the Construction Service of CPBC became the Oahu Engineer Service, USAFMIDPAC. The duties of the Commanding General, Oahu Engineer Service, were similar to those he had performed as chief of the Construction Service: to advise the MIDPAC staff on Engineer matters; to control Engineer depots and facilities on the island; to plan and direct the training of Engineer troops; to perform the construction of approved projects; to procure, store, and issue Engineer supplies and equipment; and to administer all real estate affairs for USAFMIDPAC. A more substantive change took place the following summer, on 1 July 1946, when the various elements within the Oahu Engineer Service reverted to their prewar status and USED was redesignated once again as the Honolulu Engineer District. While no longer responsible for the training of Engineer troops, HED would continue to handle all military construction projects and real estate affairs for MIDPAC and would resume the civil works activities which had been halted by the war.

Almost simultaneous with this reorganization of Oahu's Engineer forces was the reassignment of the Honolulu District to the newly established Western Ocean Division (WOD). Although the wartime mergers with other Engineer units had made HED more of a construction agency than an Engineer District, and although the demands of the national emergency had effectively stripped the office of its river and harbor functions, the District was still theoretically responsible to an Engineer Division for its civil works activities. Until August 1931 and again from June 1934 to November 1942, HED had reported to the South Pacific Division in San Francisco; for three years in the 1930's and again for most of the war, the office was under the Pacific Division, a consolidation of the North and South Pacific offices. 18 February 1946 saw the establishment of a new Division, then, with headquarters in Sausalito, California, and the transfer of HED from the Pacific Division to the new Western Ocean Division.

From its transfer to WOD in February 1946 until the establishment of the Guam District on 1 January 1947, the Honolulu District's jurisdiction extended to the Line, Gilbert, Marshall, Caroline, and Bonin Islands, and to the Marianas, Midway, Wake, Marcus, and Johnston Islands. In the summer of 1946 the District set up a field area in the Marianas, sent real estate representatives to coordinate War Department demands in Guam with the Naval Government of the island, and announced plans for troop housing construction in the Marianas. The new Guam Engineer District created on 1 January 1947, however, relieved HED of its responsibilities in the Marianas, Carolines, Bonins, and Marcus Islands and took over the Honolulu District's work in Guam. By including the Bonins and Marianas in its jurisdiction for those few months, HED extended its area of control further west than at any other time in its history.

Honolulu District Engineer at the end of World War II was Colonel Chorpening, who was succeeded in December 1945 by Colonel George J. Zimmerman and then, later in the same month, by Colonel Charles J. Jeffus. The rapid postwar turnover ended on 29 December 1945 when popular Brigadier General Bernard L. Robinson returned to Honolulu. With Brigadier General Robinson's tour began a new era of improved relations between the District and the community; the former Contracting Officer was remembered as cooperative and congenial by both the staff of HED and the residents of Honolulu. Equally well-liked and respected was Colonel Bartley M. Harloe, who served as District Engineer from June 1947 to September 1949. Colonel Harloe retired

from the Army in 1949 and since then has made his home in Hawaii. Governor Stainback also expressed his appreciation for the many courtesies extended by the Honolulu Engineers under Colonel Harloe's successor, Colonel Francis H. Falkner. Some of the District's good relations with local interests resulted simply from the nature of USED's postwar tasks: whereas during the war the Engineers had been known for land occupations, now most of their real estate activities involved the return of private property to former owners, and property restorations naturally met with more favor than had land acquisitions. Furthermore, just as criticism of HED seemed to increase in direct proportion to the District's expanded activities, now the office's popularity rose as its workload diminished between 1945 and 1950. Yet these explanations should not detract from the contributions of the officers who served as Honolulu District Engineers from 1945 to 1950. Their tact and skills went far toward improving relations between the District and the people of Hawaii.

The five years immediately following World War II witnessed a general slowdown in activity in HED. For a few months, the District maintained the rapid pace of the war period: the completion of Tripler Hospital, the disposal of millions of dollars worth of equipment, the restoration of thousands of acres of land, and the continued supplying of forward bases kept the U.S. Engineers busy during the fall and winter of 1945. By early 1946, however, signs of a cutback appeared. As recently as September 1945, CNS had employed over 11,000 men; by April 1946 this figure had dropped to 5,000. Even at the height of the breakwater repairs at Hilo, in July 1946, the Engineers released 700 workers at their Big Island base yard. The staff of the real estate office was reportedly halved between spring and fall of 1946, since, even though property disposal continued as an important activity, Army land acquisitions had virtually ceased with the end of the war. By September 1948 the entire staff of the Honolulu District numbered less than 200. Changes in office organization naturally accompanied these reductions in force, too. Between 1 May and 1 July 1948, for instance, the Dredging Area was abolished, while between July and October 1949 the Engineering and Operations offices merged to form a new Engineering-Operations Division.

This period's last two significant organizational changes occurred in 1950. On 6 June 1950, first, the Western Ocean Division was abolished and its responsibilities were transferred to the South Pacific Division (SPD). The Honolulu Engineer District was to function as before, reporting to the South Pacific Engineer, with one important exception: on real estate disposal matters, HED was authorized to report directly to the Chief of Engineers. HED remained in this status, as a District under SPD, only until 1 August. Then its shrinking workload resulted in the redesignation of the District office as the Honolulu Area Office of the San Francisco Engineer District.

In response to the growing threats of war and then to the demands of the actual conflict, HED had grown from an office of less than 500 employees to a network of 26,000 war workers. In similar though less dramatic fashion, then, as a response to the general slowdown of the postwar era, between 1945 and 1950 the Honolulu office declined from a District of 5,000 men to an Engineer Area with a staff of approximately 150.

The end of the war was responsible not only for the overall decline in HED's workload, but, at the same time, also for the continued activity of the District's Real Estate Division. Since much of the property acquired between 1941 and 1945 now had to be returned, the real estate staff kept busy even during these relatively slow years. During the war the office had purchased approximately 3,400 acres of land at a cost of $2,260,000, and in addition had administered approximately 285,000 acres under legal instruments at a yearly rental of $2,900,000. At the close of the war, the Army still held some 2,500 real estate parcels, most of which were to be released. In 1947 the establishment of the Air Force as a unit separate from the Army meant still more work for real estate personnel, whose tasks now included transferring land between these two military branches. As of 1 September 1948, approximately 25 per cent of the District's employees worked in the Real Estate Division.

Most real estate transactions between 1945 and 1950 involved the disposal of property and improvements. From March to October 1946, for instance, the real estate office conducted bid sales of improvements at ten locations in the islands, including the Pali Training Camp and the Koko Head Amphibious Training Center. A negotiated sale of improvements at a base yard on Oahu brought the total amount of these sales to $78,145.

Land disposals also took place at a rapid pace, so that over half the land leased from civilians by the Army since 7 December 1941 had been returned by 30 August 1946. That November, Lieutenant Colonel Rantzow announced the near completion of a project to restore some of Hawaii's parks to civilian use. Waimanalo Park, used during the war as an amphibious training center, would become a beach; Kapiolani Park, which had hosted an Army warehouse and base yard, would be released for use as a park. Haleiwa, Homestead, Kahuku, and Morse Fields were among those declared surplus to the needs of the War Department in February 1947. By March of that year, 75 per cent of the civilian-owned land held by the Army on V-J Day had been returned; by early 1949 only 26,000 acres remained to be released. The Army relinquished rights to land at Maili, on Oahu, in June 1949, and two months later gave up the use of certain premises at Kokee, Kauai. Both these sites had been occupied in 1941 in accordance with agreements between the Territory and the Federal Government. In June 1949 several Federal acts enabled the District to offer the Terri-

tory sections of certain Oahu military reservations for park or conservation purposes. Although the Territory chose not to buy the tracks, HED's offer represented yet another aspect of the postwar real estate disposal program.

Among the few land acquisition transactions handled by the District's real estate office from 1945 to 1950 were the negotiations for a portion of the S.M. Damon estate to be used as the site for the new Tripler Hospital. In December 1948 a Federal jury awarded the estate $326,205 for 195 acres of the property taken by the U.S. Government. An additional tract of 86.22 acres of the Damon estate was acquired in 1948 for use as part of the Aliamanu Military Reservation. Planning reports on Signal Corps cable rights of way also occupied the real estate office between 1945 and 1950. During the war the Signal Corps had laid cable lines throughout Oahu without formal real estate directives. Now, in 1947, as real estate agent for the U.S. Army, HED began the task of acquiring perpetual easements on the land already traversed by the cable lines. In most cases a nominal value of one dollar was assigned each tract and the owners willingly granted the desired easements. The planning report of 25 September 1947 covered thirty tracts located on land owned by the Oahu Railway and Land Company and stretching from Honolulu to Kahuku; the second report, completed in June 1948, concerned a shorter cable line extending from Pearl City to Aiea and Aliamanu. Included in the three planning reports issued in July 1948 were lines from Kaneohe to Kahana Bay, from Manawahua Military Reservation to Makakilo, and from Thompson Corner to Poamoho Gulch. These planning reports for the Signal Corps cable rights of way and HED's negotiations with the trustees of the Damon estate were among the few real estate projects connected with land acquisition handled by HED in the postwar period.

Just as most of the real estate transactions conducted from 1945 to 1950 were related to wartime activities, so most of the military construction of this period was directly connected with the war or with its termination. The construction of Tripler Hospital was authorized in 1944 because of the medical needs of the Pacific's sailors and soldiers, for instance, while Punchbowl Crater was designated as a final resting place for those who had died in the Pacific theater in World War II. The housing and recreational facilities constructed during this period also reflected the great number of war veterans returning to Hawaii between 1945 and 1950.

Perhaps the most important of all the military construction projects completed within the first five years after the war was Tripler Hospital. During the war the old Tripler Hospital at Fort Shafter had expanded from a 400- to a 1,000-bed capacity and the Army had converted several local high schools into additional hospital rooms. To relieve these overcrowded facilities and to provide for future peacetime medical needs, in 1944 the Office of the Chief of Engineers ordered the design and construction of a new Tripler General Hospital as a special War Department project. The hospital would be constructed under the supervision of the Honolulu District Engineer, as directed by the Chief of Engineers, and in accordance with the requirements of the Surgeon General in Washington.

The Engineers employed a variety of design and construction workers on this project. The New York firm of York and Sawyer, well-known specialists in hospital design, began architect-engineer services for the new hospital early in 1944 under a contract administered by the New York Engineer District. Later that year York and Sawyer's role was expanded to include construction management as well as design of the project, and on 9 June 1944 OCE issued the construction directive for the new hospital. York and Sawyer's representatives in Hawaii continued to perform management services, as a new Field Area 1 was established on 21 August 1944, ground was broken two days later, and the first concrete was poured in February 1945. Until 1 July 1946, Government plant and hired labor worked on the construction of the hospital; at one point over 700 Engineer employees lived at the temporary housing area erected in Moanalua. On 1 July 1946, then, construction work on the project was turned over to the joint venture of Morrison-Knudson Company, Inc., and Peter Kiewit Sons, Inc., under a cost-plus contract administered by the Honolulu District. When the contract with Hawaiian Constructors had been terminated in January 1943, the District had hired the contractor's former employees; now, conversely, when construction of the Tripler Hospital project was transferred to Morrison-Knudson-Peter Kiewit, the contractor hired over 1,300 former employees of the Government. Thus the design and construction of the new Tripler Hospital involved an east coast architect-engineer firm, Government hired labor, and a joint venture of construction contractors.

Designed to take advantage of the natural factors of its Hawaiian setting, the new Tripler Hospital complex incorporated many distinctive architectural and structural features and soon became a landmark of western Oahu. Over five miles of winding roadway were cut into the Moanalua hillside to minimize the steep grades of the site; the various pink stucco buildings were placed irregularly and informally to catch the prevailing mauka winds and to create a relaxing, residential atmosphere; canopies were installed on the main structure to protect the building from sun and rain. Landscaping received special attention from the guidance of Mr. Robert Thompson, local landscape architect, who planned over fifty types of Pacific area trees for the hospital grounds. In placing the kukui nut trees near the occupational therapy wards so patients could utilize the fruit for craft work, and in locating the plumeria and hibiscus bushes near the food service buildings so aides could easily decorate food trays,

the landscape designers considered function as well as beauty.

The hospital complex was planned as an independent Army facility complete with its own housing, messing, and recreational facilities. The buildings were of reinforced concrete rigid construction with stuccoed concrete block walls and partitions. To work with the 14-story main hospital building, the Engineers developed a giant crane with a boom of 100 feet to lift materials such as X-ray machines and to pour concrete up to the eighth floor. Possible earthquake damage was prevented by dividing the main structure into 12 individual units, each structurally isolated from adjacent units by double concrete walls, with a space between the walls. This space was closed at the exterior wall faces by means of a flexible flashing which allowed lateral movement and at the interim corridor and door openings by means of interlocking sliding thresholds. As a result, although the area sustained a mild earthquake at the end of the construction period, no structural damage to the hospital occurred. A related problem concerned the confused and unpredictable stratification of the volcanic soil at the site; to overcome this, it was necessary to take core bearings at almost every column location and then to design each column individually on the basis of those core findings, or, where the subsurface material was unsatisfactory, to drive steel H-beams as foundation piles. Internally, traffic was regulated by designing most units as dead ends to prevent needless movement through the halls. And Tripler Hospital became the first Army hospital in the country with a pneumatic tube system connecting all wards and units. These unique features of design and construction made Tripler Hospital one of HED's most interesting postwar projects.

During the course of construction, completion dates were extended while cost estimates rose. Originally completion had been set for 31 December 1945, but by V-J Day that target had been shifted to 1 October 1946, and the next month completion was rescheduled for 31 January 1947. In March 1947 the date was given as 31 December 1947, while an estimate quoted the following March promised completion during the summer. The project was finished in July 1948, the first patients moved in that August, and the hospital was officially dedicated on 9 September. The original cost estimate of $16 million had risen to $27 million by September 1945 and then to $33 million by late 1947. The total cost came to over $36 million.

These continued delays in construction and sharp increases in estimated costs prompted criticism of the hospital project. Many objected to its start during the war, when scarce materials and manpower could have been applied more directly to the military effort; others, including the Chairman of the House Military Affairs Committee, attacked the high cost of construction as wasteful. Initial delays had occurred because the project was assigned a low priority until the end of the war, when more labor and equipment could be released. Furthermore, although the Engineers procured as much material as possible from local firms, much had to be ordered from the mainland, and slow shipments from the west coast created delays in construction in Hawaii. In July 1945 the Commanding General, USAFMIDPAC, financially aided the project by allocating approximately $1.1 million in nonappropriated funds to construct the theater, bowling alleys, gymnasium, tennis courts, swimming pool, and Red Cross building which otherwise would have been eliminated from the revised plans because of mounting expenses.

At the same time, the criticism aimed at the high cost and slow progress of the hospital project was coupled with praise of Tripler's design and construction. The special features noted earlier drew appreciation from the medical officers who took over the hospital in September 1948, while area engineers from HED received special recognition for jobs well done. In 1947 Colonel Harloe presented the War Department Award for Meritorious Civilian Service to Theodore C. Madsen for his efficient handling of the discharge and rehire of project workers when construction was transferred from Government forces to the cost-plus contract in July 1946. For over two decades this pink stucco complex overlooking southern Oahu has stood as a monument to the efforts of the Honolulu Engineers. The 1,500-bed capacity Tripler Army Medical Center serves personnel and dependents of all the uniformed services, includes 500 beds allotted to the Veterans Administration and another 100 for the U.S. Public Health Service, and can be expanded for as many as 2,500 patients. In supervising the design and construction of Hawaii's only military hospital, HED contributed to the postwar rehabilitation of Hawaii's soldiers and to the medical needs of today's Armed Forces as well.

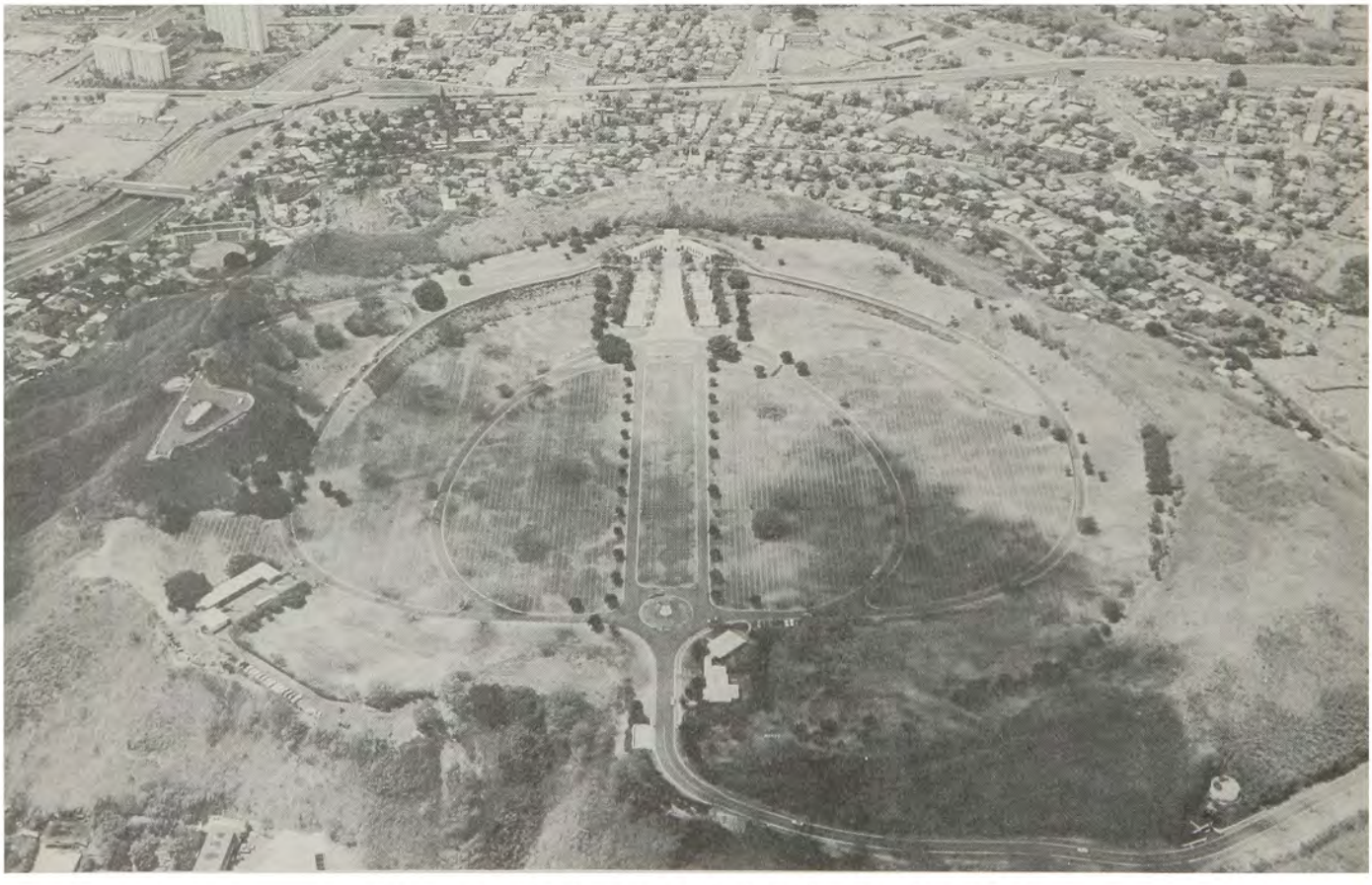
In the same way, the District's construction of the National Memorial Cemetery of the Pacific provided a burial site for soldiers who had died in World War II and a resting place for subsequent Pacific war dead as well. The cemetery met needs almost as great as those which had prompted the authorization of Tripler: the families of most men temporarily buried on Pacific islands were eager to bring the bodies to Hawaii for permanent burial, while the flimsy wooden warehouses at Schofield Barracks which housed the remains of other war dead were likely to erupt in flames. A November 1941 law had authorized an appropriation of $50,000 for construction of a national memorial cemetery in the Pacific; in early 1947, then, the District Engineer received authorization to prepare preliminary plans for the cemetery on 75 acres in the extinct volcanic crater known as Punchbowl.

As these plans neared completion in June of 1947, they met with opposition from certain local interests. The Outdoor Circle objected to the site, which

Tripler Hospital under construction in 1947.

Aerial view of Tripler Hospital during final stages of construction in 1948.

Tripler Army Medical Center, approximately twenty years after construction.



The National Memorial Cemetery of the Pacific in Punchbowl Crater, 1970.

the group hoped would become a park; the Honolulu Board of Water Supply warned of possible pollution if the city's deep wells ever had to be relocated to a site behind the crater; the Mayor and the Board of Supervisors insisted the crater was too small for a national cemetery. Opposition also came from Washington, where the Chairman of the House Military Appropriations Subcommittee called the District's estimates and request for $746,000 "outrageously high." He objected specifically to the $55,880 requested for clearing 44 acres of land, the $29,920 estimated for landscaping the area, and the $3,500 allotted for one flagpole.1

In spite of this opposition, however, in February 1948 the House passed the appropriation measure and in May the Senate approved the bill, which provided $1.1 million for the project. The District quickly let a series of lump-sum contracts for grading, the water supply system, and landscaping. Bids were opened in July 1948 and work began in August on the first phase of construction, which included the entrance gateway, the superintendent's lodge, utility buildings, an 800-foot mall with graves for 500 unidentified soldiers, and 8,000 grave sites in the center of the crater. The contract for construction of the second phase, encompassing the grading, perimeter landscaping for 7,000 more graves, and the chapel, was awarded in October, when the first phase was already 65 per cent complete.

The cemetery accepted burials even before the project was completely finished, and the first body to lie in the new National Cemetery, an unknown victim of the attack on Pearl Harbor, was buried in grave one, on row one, on 4 January 1949. Colonel Harloe has described the scene that spring, as the burials continued amidst construction activites:

> While we were still at work in the cemetery we buried about 50 of the war dead each working day. Coffins were brought from Schofield on trailers, long trenches were dug and each coffin was carefully raised by a crane and placed in a well-documented location along the trench. The bugle sounded, taps were played, the customary volleys were fired, chaplains of all faiths said a prayer. All construction activities ceased and the workmen stood at attention during each of the daily ceremonies — sad occasions but done with all reverence.2

Two thousand attended the ceremony on 19 July 1949, when the remains of Ernie Pyle, "the GI's reporter," were laid to rest in Punchbowl Crater together with the bodies of four servicemen. Although construction was not completed until 30 September, formal ceremonies on the second of that month marked the official dedication of the National Memorial Cemetery of the Pacific.

The District constructed the cemetery at Punchbowl in a little over a year and at a saving of $100,000, for the total cost came to $1 million. The 13,000 victims of World War II buried at Punchbowl have been joined by over 6,000 more bodies, and the 112-acre cemetery is the largest in area of the three national cemeteries supervised by the U.S. Army outside the continental United States. Especially fitting was the Hawaiian name for Punchbowl: "Puowaina" signified "place of resting" or "hill of sacrifice," and the crater had long been venerated as a place of repose for the weary. Both Tripler Hospital and the Punchbowl cemetery served the postwar needs of Hawaii and the nation: the hospital cared for the war's veterans, while the cemetery cared for the war's victims. Just as Tripler has continued to treat military personnel in Hawaii, too, so Punchbowl has continued to accept the dead of recent battles. Both projects also introduced HED to new areas of activity. In constructing the hospital, the Engineers discovered unpredictable lava stratification and developed a giant crane to lift X-ray machines eight stories; in building the cemetery, HED learned to schedule its work around daily burial ceremonies. Although Tripler Hospital cost over 35 times as much as the National Memorial Cemetery of the Pacific, both projects stood out as HED's most important military construction jobs in the immediate postwar years.

Less dramatic but also of interest were the other military construction projects completed by the Honolulu District between 1945 and 1950. In contrast to the temporary facilities erected during the war, most of the buildings constructed after September 1945 were designed as permanent structures. Included in the postwar construction jobs in Hawaii were many recreational facilities and housing projects for the enlarged peacetime forces anticipated after World War II. In addition, utility rehabilitation, which had been postponed during the war, was now added to the postwar program. Morrison-Knudson and Peter Kiewit Sons performed much of this construction work through supplemental agreements to their cost-plus contract for Tripler, while many additional facilities built in this period, like the recreational features of the hospital, were financed with $10 million in nonappropriated funds.

At Fort Shafter, Morrison-Knudson and Peter Kiewit Sons completed two modern, permanent, concrete barracks under supplemental agreement no.6. These three-story buildings, finished in late 1948, together housed almost 1,000 enlisted men and cost approximately $936,000 to construct. A similar modification of the cost-plus contract covered construction of the new post theater at Fort Shafter in 1947 and 1948. Of reinforced concrete, fire- and earthquake-proof, the theater cost approximately $816,000 in nonappropriated funds, was 230 feet long by 101 feet wide, and seated 995 patrons. Ceremonies on 12 May 1948 formally opened the new theater.

Schofield Barracks saw similar construction between 1945 and 1950. Permanent barracks for 200 enlisted men and 28 family housing units for non-commissioned officers were completed by Morrison-

Barracks constructed at Fort Shafter in 1948.

Knudson and Peter Kiewit in the fall of 1948, while additional roads, walks, and parking spaces were added shortly afterwards. At the same time, non-appropriated funds were expended on two swimming pools and on the rehabilitation of a small movie theater at Schofield.

As the housing projects at Fort Shafter and Schofield Barracks neared completion in September 1948, other quarters were authorized for construction in 1949 and 1950. Tripler was to receive 133 family units and a bachelor officer building which together would cost over $3 million; another $2 million would be spent on family housing at Hickam Air Force Base. Small projects provided for eighteen family quarters at the Helemano Signal Corps station and 22 units at Fort DeRussy.

By means of separate contracts with local firms, HED also installed utilities at and between these various posts on Oahu. Construction of a sewage pumping station at Fort Shafter began in the fall of 1945 and was completed by November 1946 by Oahu Construction Company, while Hawaiian Contracting Company laid a gravity sewage line from Tripler to Fort Shafter, through the taro patches of Moanalua, in the spring of 1946. Later in the year contracts with two smaller firms took care of a pressure and gravity sewage line between Fort Shafter and Sand Island and an outfall sewage line at Sand Island.

These utilities and the recreational and housing facilities described here were typical of the military construction projects supervised by HED from 1945 to 1950. Tripler Hospital, Punchbowl Cemetery, and these smaller jobs occupied most of the District's funds and energies during this period, for the war had focused on military construction while virtually excluding civil works. This pattern prevailed after the war, too, as the civil works program continued to be dwarfed by the District's military construction. Among the few river and harbor jobs performed in this period were maintenance dredging operations and hydrographic surveys at all six major harbors. The only new navigation work done between 1945 and 1950 took place at Port Allen, where the harbor was enlarged at a cost of $72,645. The Chief of Engineers had recommended this project modification in November 1940, but the war has postponed the authorization of the enlargement until the River and Harbor Act of 2 March 1945. In fiscal year 1948, then, Government plant dredged 118,904 cubic yards to create an area 200 feet wide, 1,200 feet long, and 35 feet deep at the northerly side of the existing project. The expanded harbor basin thus measured 1,500 feet long and 1,200 feet wide when the project was completed in May 1948.

While actual harbor construction took place only on Kauai, much thought was given at this time to the future development of harbors on the Big Island and Oahu. In January 1949 Colonel Harloe recommended that a Federal project be adopted for Kawaihae, on the west coast of Hawaii, at an estimated cost of $5,576,500; in May 1950 a River and Harbor Act approved the construction of a harbor basin, entrance channel, and breakwater. The deep-draft harbor at Kawaihae, completed in 1959, was thus authorized in the five year period immediately following World War II. The same era saw further consideration of the second entrance channel to Honolulu Harbor, for the dredging of part of the channel during the war had prompted more discussion of the proposed project's merits. When the freighter **Britain Victory** effectively blocked Honolulu Harbor by running aground on the reef in November 1946, local interests urged the speedy authorization of a second entrance to the harbor. Colonel Harloe held a public hearing to confirm local support and in October 1948 recommended the dredging of the channel. The District Engineer noted that since 1903 eighteen groundings had blocked Honolulu Harbor for various periods of time and that even under normal circumstances a second entrance would reduce off-port waiting time and hence lower the cost of commerce. Circulation of stagnant water in a pocket of Kapalama Basin was cited as another reason for recommending the second entrance channel.

In proposing the construction of the $2,380,000 project, the District Engineer recommended that the rear entrance to the harbor be excavated to a depth of 35 feet, with a width of 400 feet over a distance of 5,850 feet seaward from Kapalama Basin and gradually increasing to a width of 1,000 feet over an additional length of 4,150 feet. A drawbridge with a clear opening of 200 feet would be constructed across the channel, the existing causeway would be removed, and the Territory would maintain and operate the completed bridge. Colonel Harloe's suggestions would probably have met with Congressional approval in 1950, but in July of that year the President directed the Secretary of the Army to defer, curtail, or slow down all civil works projects which did not contribute directly to defense. Once again the history of Hawaii's harbor projects depended on the history of the world, for the Korean conflict halted much of the District's civil works program in the early 1950's. The second entrance channel recommended by Colonel Harloe in 1948 was authorized as a Honolulu Harbor project modification by the River and Harbor Act of 3 September 1954.

From 1945 to 1950, then, HED's navigation work focused on studies and reports for future projects. In addition to surveying at Kawaihae and Honolulu, the District Engineer also investigated the harbor at Nawiliwili and in early 1950 recommended its enlargement by dredging an area 35 feet deep and 440 feet wide to the west of the existing channel. Like the second entrance channel at Honolulu, this modification to the project at Nawiliwili was set aside until 1954, when the River and Harbor Act of 3 September authorized the harbor expansion. These studies, the routine maintenance of the islands' harbors, and the enlargement of the Port Allen basin would have constituted the District's entire navigation program in the postwar period — had not one of Hawaii's most disastrous tidal waves struck the islands on 1 April 1946.

A tidal wave, or, more accurately, a tsunami, may occur when an earthquake or seismic disturbance creates a fault on the ocean floor and a series of waves is propagated at tremendous speed. In deep water, wave velocities of 500 miles per hour and wave lengths of over 100 miles go unnoticed; in shallow water, however, near the shoreline, bottom friction suddenly retards the front section of the wave, causing that portion to be overrun and the wave to peak. Hydrographic features of a coastline affect the wave's properties, and the location and resonance of Hilo Bay happen to amplify the destructive quality of waves approaching Hawaii. The 1946 tsunami was the sixth "very severe" wave to hit Hilo since 1837.

Originating in a violent earthquake in the Aleutian Islands almost 2,400 miles from Hilo, the tsunami's waves sped toward Hawaii at over 450 miles per hour and reached Hilo at 7:00 a.m. on 1 April 1946. The wave claimed 96 lives on the island, caused an estimated $30 million worth of damage in Hilo alone, and reduced 60 per cent of the breakwater from its 11-foot height to an average of three feet below low tide level. Even the damaged breakwater, however, helped reduce the effect of the wave on the eastern section of the city.

Within a week after the tsunami, the Honolulu District began the emergency repair of the largest break, a 1,200-foot gap adjacent to the shore. $500,000 of special Army funds were used to complete this repair by 8 August. This initial reconstruction then provided the harbor with a continuous usable breakwater section 4,650 feet long. On 3 and 5 January local storms inflicted new damage on the reconstructed portion of the breakwater and forced the Engineers to redirect their efforts temporarily to the repair of the seaward slope of the shoreward section. Turning once more to the reconstruction of the tsunami-damaged barrier in February 1947, the District found that the one bid received for the break-

Main street of Hilo, Hawaii, after tsunami of 1 April 1946.

water repair was considerably higher than the Government estimate. Since HED had acquired some floating plant during the war, the District Engineer requested permission from the Chief of Engineers to use that Government plant with hired labor to finish the reconstruction. OCE agreed, and HED's barge-mounted cranes and small tugs completed the job for approximately half of the bid price. Upon completion of the breakwater repair the District had to sell all its floating plant as surplus and resorted once again to borrowing plant from west coast districts for periodic maintenance and repair.

Quarrying operations in connection with the breakwater repairs at Hilo proved a challenge to the Honolulu District. Floating derricks and barges managed to recover much of the eight- and ten-ton capstones which had been quarried especially for the original breakwater and had washed over in the wave. For core rock, at first the District used the Hilo airport quarry, but when that site closed the Engineers had to haul rock by barge and tug from a quarry on Maui to the Big Island. Since the brittle, igneous rock of the islands tended to split easily, small powder charges were used to procure large pieces. The eight- and ten-ton stones were "keyed in" so that they provided mutual support.

By 30 June 1947, the first four breaks from the shoreward end of the breakwater had been reconstructed and 100 feet of the fifth break had been repaired, to afford an unbroken span of 5,415 feet. HED finished the complete reconstruction of the 6,030 foot damaged portion in February 1948, restoring the full length of the barrier to approximately 10,085 feet. The high cost of repairs can be seen dramatically in this table of funds expended for maintenance at Hilo Harbor:

For fiscal year ended	Funds expended for maintenance, Hilo
1943	$ 3,193
1944	5,128
1945	7,555
1946	120,954
1947	660,095
1948	667,025

While the total spent for harbor improvements at Hilo from 1907 to 1 April 1946 was just under $3.5 million, in the next two years an additional $1.5 million was expended on breakwater repairs alone. The extensive damage and loss of life resulting from the tsunami of 1946 and the large sums needed to restore the breakwater prompted a series of tsunami protection studies, beginning with the survey required by the River and Harbor Act of 24 July 1946 and culminating in the model testing performed at Honolulu's Look Laboratory in 1964 and 1965. The Engineers' work at Hilo immediately after the 1946 tidal wave was thus only the prelude to two decades of investigations and experiments in tsunami protection.

The tsunami of 1 April 1946 also hit Kahului Harbor on Maui but caused considerably less damage there than at Hilo. In August and September of that year HED spent $7,000 to restore part of the 200 to 300 cubic yards of cap rock which had been displaced on the shore end of the west breakwater. The storms of 3 and 5 January 1947 destroyed more of the barriers at Kahului than had the tidal wave: the heavy seas displaced 195 feet of cap rock on the shoreward end of the east breakwater and 500 tons of cap rock on the west breakwater while forcing two complete breaks totaling 601 feet on the east barrier and one 354-foot complete break at the top of the west barrier. Reconstruction of the two breakwaters began in June 1947 and was completed a year later. In fiscal year 1945 the District had spent $208 on maintenance at Kahului and in 1946, $121; in 1947 the figure jumped to $42,626 and in 1948 to $683,346. While not as extensive as the work at Hilo, the repairs of the breakwaters at Kahului nevertheless represented a significant maintenance project in the development of the harbor. Nor was this reconstruc-

View of Hilo Harbor breakwater showing breaks in barrier August 1947.

Hilo Harbor breakwater after repair of break 7, October 1947.

tion the last at Kahului, where shoaling and breakwater damage had always presented problems for the Engineers. Even the major rehabilitation of the breakwaters which was completed in late 1966 has been followed by additional strengthening.

HED devoted much of its time, manpower, and equipment to the breakwater repairs at Hilo and Kahului. Colonel Harloe later presented two awards for Meritorious Civilian Service to members of his staff for their contributions to this project: to Alfred O. Strandberg for planning and estimating the repairs at Hilo so as to save the Government money; and to Donald R. Forrest for initiative displayed in devising a quick and accurate means for gauging barge submergence for use on the repairs at both harbors. Governor Stainback likewise was pleased with the Engineers' quick work and in June 1946 commended the USAFMIDPAC forces for their "invaluable service to the Territory" during the April wave.[3] In reconstructing the breakwater at Hilo the District had expanded its reach still further, this time to new quarrying techniques and the operation of its own plant on a navigation project. While Tripler Hospital and Punchbowl Cemetery represented new endeavors in the field of military construction, the emergency repairs at Hilo and Kahului led HED into a new arena in civil works.

Also begun at this time as a new civil works activity for the Honolulu District was its flood control program. In 1936 Congress had designated the Corps of Engineers as the Federal construction agency for flood control, and the 1939 Flood Control Act had authorized studies of several rivers on three of Hawaii's islands. On Oahu, the Anahulu River and tributaries in the Waialua district and Kawainui Swamp in Kailua were to be investigated; on Kauai, the Waimea, Hanapepe, Wailua, and Hanalei Rivers and Kapaa Swamp were listed; while on the Big Island, Wailoa Stream and its tributaries were to be the subject of a third investigation. Major Bermel quickly began preliminary studies for these flood control surveys. In October 1939 the District Engineer asked the Mayor of Honolulu to appoint a citizens committee to collect data on Anahulu River and Kawainui Swamp. Captain Robinson visited Kauai in November 1939 in preparation for the public hearing held there in early January, and seven District employees returned to Kauai for additional surveys in March of 1940. On Hawaii, Major Bermel met with local officials in November 1939 to discuss plans for flood control surveys on the Big Island. At this point, of course, the outbreak of war in Europe and the consequent defense buildup in the Pacific interrupted most Corps flood control programs, so that construction did not begin on flood control works for Hawaii's rivers and streams until after World War II. In the area of civil works, as in the field of military construction, HED's activities depended on distant events.

First to see authorization as a flood control project in the Honolulu District was the plan prepared for Kauai's Hanapepe River, the only site on that island then selected for protection. In November 1939 local interests had concluded that it would be cheaper to relocate the town of Hanapepe than to construct flood control works; the Chamber of Commerce finally agreed "to await the visit of the Army engineers before taking any definite action."[4] The Engineers arrived later that month, and the District Engineer submitted a preliminary report in June 1940 and a survey report in March 1942. The Flood Control Act of 22 December 1944 then authorized the project, which provided for the construction of a 2,000-foot reinforced concrete flood wall, 7 to 11 feet high, along the left bank of the river from the new Kauai belt highway bridge to the cliffs at the northeast corner of the town of Hanapepe. The estimated cost for new work, set at $73,000 in 1942, rose to $235,000 in 1948. In addition to the usual terms of cooperation, local interests were to raise the roadway at the upstream end of the flood wall and to remove a 250-foot narrow-gauge trestle bridge.

By 30 June 1950 HED had completed 75 per cent of a definite project report for Hanapepe River. Just as World War II had postponed the authorization of this project, however, now the Korean conflict halted actual construction. Although the original project was not completed until 1959 and the modified project not until 1963, flood protection for Hanapepe River was significant even in the postwar period as the first such work authorized in the Honolulu District.

In August 1948 the District Engineer submitted his report on the Oahu rivers studied under the 1939 Flood Control Act. An unfavorable recommendation on Anahulu River and the other streams of the Waialua district was accompanied by a favorable report on Kawainui Swamp at Kailua. Major Bermel had held a public hearing on Kawainui as early as January 1940, when he determined that local interests wanted a new outlet from the swamp to the sea, a control dam, and a protecting levee. By the time plans were resumed after the war and another public hearing held in April 1947, Kailua had begun to develop into a residential area. Local interests now urged flood control measures to prevent beach pollution as well as to protect the area from flooding and urged the Engineers to locate the outlet channel so as to bypass beach property.

The Flood Control Act of 17 May 1950 authorized the Kawainui project as recommended by the District Engineer in 1948. An unlined tidewater flood channel 9,525 feet long, 105 feet wide at the bottom, and approximately 13 feet deep in the main portion would be constructed, along with a reinforced concrete and timber control structure 350 feet wide at the inlet to the channel. The outlet channel was to provide flood protection by discharging flood waters from the swamp into Kailua Bay, while the control structure would prevent sea water from entering through the channel and would also allow the continued storage of irrigation water in the swamp

basin. Of the total estimated first cost of $1,079,574, Federal expenses were to be $848,094. The hiatus imposed by the Korean War and confusion over the anticipated use of the Kailua area postponed the project's completion until 1966. As with the plans for Hanapepe, a long road lay between authorization and construction of flood control works for Kawainui Swamp.

Flood protection on the Big Island followed the same pattern. In accordance with the requirements of the 1939 Flood Control Act, in September 1941 the District Engineer submitted a favorable survey report on Wailoa Stream near Hilo. The war deferred further studies, and the District Engineer's report of April 1949 was transmitted to Congress in March 1950. The Engineers had considered several plans for each of the three sections of the Wailoa River flood plain: the lower Waiakea, the lower Hilo, and the upper Waiakea areas. By early 1949 Colonel Harloe had concluded that the benefit-cost ratios were too low for the latter regions but that improvements were warranted in lower Waiakea. The project, as recommended in 1949 and authorized by Congress in September 1954, provided for the construction of a diversion dike and channel about 3,530 feet above Kinoole Street to divert Kawili Stream into Waiakea Stream; the improvement of an existing channel of Waiakea Stream between the proposed diversion and Kinoole Street; and the construction of a new unlined channel from Kinoole Street to Waiakea Pond. Federal costs were expected to be $270,000; the local contribution would come to $108,000.

The flood control project for Wailoa River was not completed until August 1965, for the same reasons responsible for delays in the rest of HED's flood protection program. World War II had interrupted initial flood control studies; now the Korean War was to tie up civil works funds before the Hanapepe and Kawainui projects could receive appropriations and even before the plans for Wailoa could be authorized.

Although HED's flood control activity in the immediate postwar period focused on surveys and reports, the District did complete one small flood protection project. Section 205 of the Flood Control Act of 1948 had authorized small flood control projects which were urgently needed, fully justified, and noncontroversial, without requiring the usual authorization procedures. The District Engineer chose Kaunakakai Stream on Molokai as HED's first small flood control project; the District awarded a contract in June 1950; and in December of the same year Colonel Falkner transferred the completed half-mile long leveed channel to the government of Maui County. Federal costs of the levee had totaled approximately $73,000. Thus in the midst of extensive planning for major flood control projects on Kauai, Oahu, and Hawaii, the District completed its first flood control job on the tiny island of Molokai.

With the construction of the project at Kaunakakai and the preparation of reports for flood control works at Hanapepe, Kawainui, and Wailoa, then, the civil works activities of the Honolulu District were expanded to include flood protection as well as harbor improvements. The postwar period also saw the District Engineer engaged in emergency repairs at Hilo and Kahului at the same time that he studied flood control projects on Oahu and Kauai and directed new work at Port Allen. Nor were HED's military jobs limited in scope. Before Morrison-Knudson-Peter Kiewit had finished constructing Tripler Hospital, other Engineer contractors had already begun to grade Punchbowl Crater for the National Memorial Cemetery of the Pacific. The District also supervised the construction of housing, recreational, and utility facilities during the same years. Because of the general slowdown in activity after World War II, HED carried a relatively light workload from 1945 to 1950, with military construction predominating over civil works. These trends were to continue into the 1950's, too, when the Honolulu office would function as an Engineer Area. Even in these slower years, however, HED branched out into new and varied endeavors, and the pink hospital at Moanalua, the National Cemetery at Punchbowl, and the reconstructed breakwater at Hilo still stand as reminders of the variety of work performed in the postwar era by the Honolulu District.

Footnotes — Chapter VII

1. The **Honolulu Star-Bulletin**, 8 July 1947, p. 5, col. 1.
2. Col. Bartley M. Harloe to Ellen van Hoften, 1 December 1969.
3. The **Honolulu Star-Bulletin**, 6 June 1946, p. 8, col. 4.
4. **Ibid.**, 6 November 1939, p. 7, col. 2.

CHAPTER VIII: The Area Years

Like the five year period immediately following World War II, the decade of the 1950's also represented a relatively quiet time in HED's history. The Honolulu Engineers' activities continued to reflect national and world trends throughout the 1950's. Just as World War II had transformed the office from a small civil works agency to a huge military construction concern, and just as the slower pace of the postwar era had contributed to a lighter workload for HED, so now the Korean War played a part in the development of the Honolulu District. The effects of the Korean conflict were twofold: whereas American entry into World War II had dramatically boosted HED's military construction activity, the immediate effect of U.S. participation in the Korean War was to cut off many of the District's civil and military programs. By the end of 1953, however, the Honolulu Engineers felt the second effect of the war in Korea, as funds were released for previously authorized projects and new jobs were begun to meet the needs of a nation now committed to a permanent armed force. As a result of America's role in the Korean conflict, then, HED experienced first a slowdown and then a gradual rise in the level of its activity between 1950 and 1957.

To effect personnel and financial savings, and as a consequence of the diminished workload of the postwar era, on 1 August 1950 the Honolulu District was redesignated as the Honolulu Area Office of the San Francisco Engineer District. The office would remain in this status until 1 July 1957, when HED was reestablished as a District under the new Pacific Ocean Division. From 1950 to 1957 the Area's jurisdiction included the Hawaiian, Gilbert, and Marshall Islands as well as Wake and Midway. Colonel Falkner continued as Area Engineer until August 1951, when he was succeeded by Lieutenant Colonel David M. Matheson. Lieutenant Colonel Sidney Shelley then took over in October 1953 and served until August 1956. Area Engineer when the office returned to district status on 1 July 1957, Lieutenant Colonel MacGlachlin Hatch remained in office as District Engineer for two more years.

From 1950 to 1953, then, the conflict in Asia meant less work for the Area, while after 1953 the war's end contributed to a small increase in Engineer activity in Honolulu. Reflecting this fall and rise in workload were definite shifts in office size. Although the staff grew between January 1950 and January 1952 from approximately 130 to about 160 employees, a manpower survey conducted by the South Pacific Division in April of 1952 led to determined efforts by SPD and the San Francisco District to reduce personnel and costs to correspond with the shrinking workload in the Honolulu Area. The number of motor vehicles was cut from 36 to 25 by the end of 1952; excess office space was offered to other Federal agencies; the marginal wharf at Sand Island was scheduled for release. By early 1953 Lieutenant Colonel Matheson had reduced the number of Design Branch personnel from 20 to 12 and planned for architect-engineer firms to handle more of the Area's design work. In January 1953 Honolulu Area Office employees totaled approximately 120.

That month the San Francisco District learned that the President's budget included no civil works funds for either planning or construction in Hawaii. Although reluctant to destroy local faith in the Honolulu Engineers, SFD did consider closing down the Area Office entirely, lest the District be forced to subsidize the Area. That drastic measure was not taken; instead, in March and April of 1953 the Area experienced further personnel cutbacks designed to reduce the Honolulu office to a cadre organization whose staff would be augmented in peak periods by personnel loans from the mainland. Within one month, two mail and records clerks, the Chief of the Supply Section, and seven engineers received notices that their positions had been abolished. At the same time the District Engineer directed that some Construction Division inspection personnel be placed in leave status at times when their services could not be utilized. By the end of March, the District staff had shrunk to 94. Also as a result of this economy drive in early 1953, all office personnel of the Engineering Division moved into one large room to expedite handling projects and to cut occupied floor space from 6,239 to 3,442 square feet. Mail and records employees would no longer log incoming correspondence, while prospective bidders would not be required to make deposits for obtaining plans and specifications. This last step was intended to save personnel time in the Contracts Branch, the Fiscal Section, and the Finance Office. Even some telephone equipment was removed, for an anticipated annual savings of $500.

The Area Engineer also consolidated several offices in order to reduce personnel. The Chief of the Administrative Branch was to serve additionally as Chief of the Fiscal Section, while the head of the Engineering Division would act as Assistant Area Engineer as well. In addition to consolidating these jobs, Lieutenant Colonel Matheson also abolished the Personnel Branch of the Honolulu Area Office, and later, in 1954, the Construction and Operations Divisions were merged. The Area's personnel force dipped to its low point in 1954, when employees numbered between 75 and 85. No sooner had the office reached this point, however, than the post-Korean War boom began to boost staff numbers. By April 1955 the Area's authorized civilian and military strength had risen to 94; in July 1956 approximately 125 worked for the Area; and by January 1957 the staff had increased to over 175. Still nowhere near the 26,000 employed by the Engineers in 1943, nor even close to the 5,000 on the rolls in April of 1946, these figures nevertheless represented an increase in both personnel and workload after 1953.

Also indicative of the Area's development from 1950 to 1957 was the number of field offices maintained by the Honolulu Engineers. The four project offices listed in the January 1952 organization chart shrank to three by July of that year and to only two, at Hickam and Johnston Island, by January 1953. With the end of the war and the release of construction funds, then, more projects meant more field offices. In January 1955 the Area supervised four resident offices, in July 1956 managed seven, and by January of 1957 had added two more. These nine offices directly reflected the Area's major projects, for they included units at Hickam and Johnston Island, branches at Kahului and Nawiliwili, and, in 1957, a Capehart Housing Projects Office and a unit at Kawaihae. The number of field offices in the islands as well as the fluctuating personnel force mirrored the ups and downs of the Area's activity from 1950 to 1957.

During these years the Honolulu Engineers continued to exhibit the camaraderie first noted in the late 1930's. The Area contributed a column to the San Francisco District's monthly newspaper, **Parapet**, and Lieutenant Colonel Shelley's skills recalled the days of Captain Robinson, for the Area Engineer led the office bowling league with a high score of 245. Aloha Week festivities highlighted the autumn months; in 1954 the Aloha Week Court visited the Engineers' celebration, while in 1955 the traditional party featured refreshments in the Materials Testing Laboratory. In September 1955 the Area held its first office-wide picnic, at the beach at Bellows Air Force Base — whose runways many of the staff had helped to pave in those frantic hours after the Pearl Harbor attack. Later that year, the visit of Colonel John A. Graf, San Francisco District Engineer, provided an opportunity for Lieutenant Colonel Shelley to invite the entire Area staff to his quarters for a gala Christmas party. Perhaps most significant of all the celebrations held during the Area years was the party of 15 April 1955 which marked the 50th anniversary of the establishment of the Honolulu Engineer office. At this time Mrs. Albert K.B. Lyman, wife of the late District Engineer, unveiled a plaque listing the names and years of administration of Honolulu's 38 District and Area Engineers. The continually updated plaque still hangs in the foyer of the District office building at Fort Armstrong. At this ceremony, as at the other after-hour occasions on which Engineer employees gathered, the Area maintained a spirit of comradeship which has characterized HED's history.

Mrs. Albert K. B. Lyman unveiling the plaque at 50th anniversary ceremonies at Fort Armstrong, 1955.

The office reorganizations and the changing levels of the personnel force described above merely reflected the more significant fluctuations in both civil works and military construction programs during the Area years. The slowdown of the early 1950's was perhaps most apparent in the area of civil works, and, within that area, in the field of navigation projects. In a sense, the Engineers had run out of Hawaiian harbors. With the completion of dredging operations at Honolulu, Hilo, Kahului, Nawiliwili, Port Allen, and Kaunakakai, each of the major islands were serviced by at least one deep-draft harbor, and these six ports seemed to meet the Territory's commercial needs for the time being. These needs were diminishing in the early part of the decade, furthermore, in yet another example of HED's

close ties with world developments. By 1950 ships en route to Hawaii were being overtaken by airplanes, and the Honolulu Area Office accordingly shifted some of its attention from harbor improvements to airfield construction. In January 1956, for example, Lieutenant Colonel Shelly noted that during the coming year the Area would spend or contract for $7,800,000 worth of military work, in addition to several anticipated jobs on Capehart housing, but only $1,120,000 worth of civil works projects.

Earlier in the decade, too, the national defense program had specifically eliminated certain navigation projects in Hawaii; in December 1951, Lieutenant Colonel Matheson announced cuts in funds for the investigation of possible small boat harbors on Hawaii's coasts and for studies of Kewalo and Ala Wai Basins. Even though Hawaii's flood control and beach erosion programs gathered some momentum after 1953, many of the Area's navigation projects remained inactive for most of the decade, and the years between 1950 and 1957 saw new construction only at Kawaihae and Nawiliwili. Thus, because of both the Korean conflict and the rising importance of commerce by air, studies and reports rather than actual construction made up much of the Area's activity in the field of navigation work.

The River and Harbor Act of 17 May 1950 had authorized several investigations, including those of Hawaii's coasts and of Kewalo and Ala Wai Basins for which funds were curtailed in late 1951. The Area conducted a survey on Honolulu Harbor to determine measures necessary to provide relief from pollution and debris, and turned in an unfavorable recommendation in 1951. Later the Area Engineer also reported unfavorably in the feasibility of providing additional anchorage areas in Honolulu Harbor. At the request of the Territorial Legislature, in April 1953 a House Committee on Public Works resolution called for a study of Kahului Harbor to determine the advisability of enlarging the turning basin of the west end of the harbor. After public hearings in the spring of 1956, the Area Engineer recommended the harbor be expanded. The construction of the project modification, authorized by the 14 July 1960 River and Harbor Act and completed in 1962, is discussed in Chapter IX.

Most interesting of all the studies conducted by the Honolulu Area in this period, perhaps, was that which examined the possibility of tsunami protection at Hilo Harbor. Although the District later revised the recommendations made in late 1957, this survey marked the beginning of the Engineer's determination to prevent tidal wave damage on the Big Island. The study also illustrated the important part environment has played in shaping HED's history. In the 1930's the District had studied lava barrier protection for Hilo and then dredged through a hard coral reef at Midway. Now, as an Area, the Honolulu Engineers took up the study of tsunami protection and continued this project well into the 1960's. Much of HED's activity has been molded by the geography of the Pacific islands.

Under authority of the River and Harbor Act of 26 August 1937, Major Bermel had recommended the construction of breakwaters to eliminate surge in the pier area at Hilo, although the Division Engineer had subsequently vetoed the plan because of insufficient economic justification. In 1949, Colonel Harloe had reported favorably on a flood control project for Waiakea Stream above Hilo city. As further background for the tsunami protection studies of the late 1950's, the wave of 1 April 1946 led to the authorization later that year of a preliminary examination of Hilo Harbor to consider enlarging the entrance channel and harbor basin; providing an anchorage basin for fishing craft; constructing a breakwater to eliminate surge; building a small boat harbor; and, lastly, erecting a seawall to protect the city against tsunamis and high tides. In June 1947 the District Engineer recommended a survey not be made, but local interests persuaded the Engineers to reconsider the last item. On 30 April 1948, then, the Chief of Engineers directed HED to conduct a survey on the feasibility of constructing a seawall to protect Hilo city from tsunamis.

A public hearing was held in March 1950, but the cutbacks of the early 1950's and the fading memory of the force of the 1946 wave postponed further consideration of the seawall proposal until later in the decade. On 9 March 1957 a new tsunami hit Hilo, caused over $2 million in damage, and partially destroyed the breakwater. This wave, coupled with the new civil works funds now available, spurred the Area to action, and on 30 August 1957 Lieutenant Colonel Hatch held another public hearing to consider tsunami protection. His report of December 1957 proposed the construction of a cyclopean masonry wall approximately 28 feet high and a gated structure at Wailoa River to prevent the entrance of tsunami waves. First cost to the Federal Government was estimated at $5,775,000.

The District Engineer noted that such a seawall would prevent excessive damage from tsunamis of severe magnitude but labeled the wall "only partially effective" against "very severe" waves such as that which hit in 1946. Partly for this reason, and also because the tsunami of 23 May 1960 hit the eastern portion of the city, which would not have been protected by the proposed wall, Lieutenant Colonel Hatch's plan for a seawall remained in survey status. The studies conducted by the Honolulu Area Office during the 1950's set the stage for the next decade's experiments at Honolulu's Look Laboratory on other means of protecting Hilo against tsunami waves.

The same period that saw the proposal of a plan for tsunami protection at Hilo also witnessed the authorization of the second entrance channel to Honolulu Harbor. The Kalihi Channel project had been considered for the first time as early as 1913 and was rejected again in 1931, although the entranceway was partially dredged with military

funds during World War II. Not until after the war was the second entrance channel dredging approved as a civil works project. The plans recommended by Colonel Harloe in 1948 reached Congress four years later and were authorized as a project modification by the River and Harbor Act of 3 September 1954. The authorization provided for an entrance channel extending seaward from the west end of Kapalama Basin, 35 feet deep and 400 feet wide for 5,800 feet, thence increasing to a width of 1,000 feet in a distance of 4,150 feet; and the installation of a pontoon drawbridge or other suitable movable bridge across the second entrance channel, with a minimum clear horizontal draw opening of 200 feet. Although actual construction did not begin until the 1960's, the project received Congressional approval in 1954, while the office was still an Area. With the inclusion of the second entrance channel in the existing project for Honolulu, the Engineers continued the harbor's westward expansion which had begun with the first dredging of the Reserved Channel in 1917. Over forty years had passed between Major Wooten's initial examination and rejection of the Kalihi Channel proposal and the project's actual authorization. Yet another decade would elapse between authorization and completion.

Reports and surveys made up most of the Area's navigation activity between 1950 and 1957, then. Among some of the more unusual navigation tasks performed by the Honolulu Engineers in this period was the installation of an automatic recording wave gauge near Black Point on Oahu. This device, operated in cooperation with the U.S. Army Engineer Beach Erosion Board in Washington, D.C., and located in 30 feet of water 2,000 feet off the island's south shore, measured differences in hydrostatic pressure due to wave action by sending wave impulses to a recording unit on shore. Another interesting project of the same epoch involved the Area's inspection of a contract for barge reconstruction. Mr. John S. McDougal, Assistant Area Engineer, was responsible for inspecting the Hawaiian Dredging Company's contract for the rehabilitation of a hydraulic barge for the United Nations Korean Reconstruction Agency in the summer of 1953. Even in these relatively quiet years, HED continued to perform unusual jobs.

Soon after the end of the Korean War, the Area found itself involved in civil works construction as well as in surveys and reports. In March and April of 1954 the Engineers operated the hopper dredge **Biddle** in Pearl Harbor at the request of the Navy. In late 1955 the dredge **Davison** arrived on loan from the Portland District and in the next few months conducted maintenance dredging operations at Nawiliwili, Port Allen, Honolulu, Kaunakakai, and Kahului Harbors. More significant than these routine jobs, however, was the construction of a new Federal deep-draft harbor at Kawaihae. Not since the dredging of Port Allen and Kaunakakai Harbors with NIRA funds in the 1930's had Hawaii received a major new harbor. The completion of the project at Kawaihae not only increased the number of ports in the Territory but also provided the largest island in the chain with two Federal harbors. Hilo would serve the eastern region of the Big Island, while Kawaihae now could handle commerce for western Hawaii. The harbor's construction was hailed as an "economic shot in the arm," for sugar planters in the Kohala region of the island would no longer have to ship their crops overland to Hilo or to Kailua-Kona. The harbor would serve military needs as well: the Army was about to acquire a 100,000-acre training site nearby and could unload supplies at Kawaihae Harbor. Local residents also noted that, were Hilo Harbor blocked by a flow of lava, the new port at Kawaihae could service the entire island. Great excitement therefore accompanied the construction of the harbor at Kawaihae.

As noted in Chapter VII, the River and Harbor Act of 17 May 1950 provided for the Kawaihae Harbor project, which was to include an entrance channel 400 feet wide, approximately 2,900 feet long, and 40 feet deep; a harbor basin 1,250 feet square and 35 feet deep; and a breakwater with a maximum crest elevation 13 feet above low water and approximately 4,400 feet long, of which 3,200 feet would be protected with heavy stone revetment. By the end of 1954 the Area had sufficient funds to begin detailed planning. That fall a five-man hydrographic survey team made subsurface explorations in west Hawaii; the next spring the Engineers visited the quarry site selected as a source of breakwater material; and in September 1955 the staff completed the design memorandum. Since only $50,000 was appropriated for the project for fiscal year 1955 and nothing for 1956, the Territory meanwhile went ahead with its own plans for Kawaihae. By 30 June 1955 the local government had completed a channel 200 feet wide, 1,800 feet long, and 20 feet deep and a turning basin 250 feet square and 10 feet deep in the vicinity of the site of the proposed Federal project.

An appropriation of $1,700,000 for fiscal year 1957 allowed the Area to begin actual construction of the Federal harbor, and in January 1957 the Engineers awarded the first two contracts for preliminary work on the harbor project. By 30 June 1957 most of the causeways, dike, and revetment had been completed; a year later the entrance channel and harbor basin had been dredged; the breakwater was finished in June of 1959. That August, when the Territory had completed its extensive terminal facilities, the harbor was opened to transpacific traffic. The Governor, the District Engineer, and other distinguished guests officially dedicated the Kawaihae Harbor project on 15 October 1959, by which time the total Federal cost of new work was just over $4.1 million. The progress of the Kawaihae Harbor project illustrated the pace of the Area's navigation work during the 1950's. Authorized in 1950, the project awaited the end of the Korean War before detailed planning could begin and was completed two

years after the office returned to district status. The harbor at Kawaihae gave all of western Hawaii an economic lift and represented the most important navigation project constructed by the Honolulu Area Office in the 1950's.

Kauai as well as Hawaii saw new work in the Area years, although the construction at Nawiliwili was a harbor enlargement rather than a new project. At public hearings held in February 1949 local residents had expressed their wish for harbor expansion; within a few years the Area Engineer had recommended the improvements; and in September 1954 the same River and Harbor Act which authorized the dredging of the Kalihi Channel at Honolulu approved the project modification for Nawiliwili. The entrance channel at Nawiliwili was to be deepened to 40 feet; the harbor basin would be enlarged by dredging along its westerly side an additional area 440 feet by 1,230 feet; and the revetted fill area would be constructed by depositing dredge spoil between the shore and the bulkhead line west of the harbor basin. In addition to the estimated Federal costs of $1.1 million, local interests were to contribute approximately $40,000 to construct the revetment of the fill area. With the termination of the Korean conflict, the Area's navigation projects moved more quickly than earlier in the decade, and work began at Nawiliwili just over a year after authorization, in December 1955. Both the Government dredge **Davison** and the contractor's plant worked on the project modification. By October 1956 the newly authorized portion was complete except for two areas on the sides of the entrance channel which would be dredged in 1960. In contrast to the new project at Kawaihae, this modification of Nawiliwili Harbor was practically completed within two years of authorization.

Dredging between 1950 and 1957 thus centered on the projects at Kawaihae and Nawiliwili. The Engineers also performed some work on the islands' breakwaters when several of the barriers were damaged by storms in early March of 1954. At Kahului, the storm damaged the seaward ends of both breakwaters, destroying 185 feet of the east and 300 feet of the west barrier and forcing the port to close temporarily; at Hilo, waves breached a 50-foot section of the breakwater and washed out core material to an elevation of plus two feet; at Nawiliwili, the storm damaged 100 feet of the breakwater and destroyed the aid to navigation located at the end of the barrier. Lieutenant Colonel Shelley declared in April, "Immediate repairs . . . are mandatory," and urged their completion before October's anticipated storms.[1] Another year or two passed before funds were allotted for the breakwater rehabilitation, however, and the reconstruction of the barrier at Nawiliwili did not begin until after the office was once more an Engineer District. In April 1956 the Hawaiian Dredging Company began the rehabilitation of the breakwaters at Kahului with 33-ton concrete tetrapods and in February 1957 finished the repairs at a cost of $1.2 million. This rehabilitation at Kahului, where waves had caused considerable damage in the past, was the first breakwater job on which the Honolulu Engineers used precast concrete units. Later, in 1958 and 1959, the District would undertake the reconstruction of the barrier at Nawiliwili with precast tribars, and still later, in the 1960's, HED would return with tribars to Kahului as well. In the meantime the Engineers also supervised the repair of the breakwater at Hilo in the spring of 1957 at a cost of approximately $70,000.

Aerial view of Kawaihae Harbor, Hawaii, January 1959.

The construction of Kawaihae Harbor, the enlargement of the basin and channel at Nawiliwili, and the rehabilitation of the breakwater at Kahului thus highlighted the Honolulu Area's navigation work between 1950 and 1957. In the field of flood control, activity was also slow and was marked by more plans for Hanapepe River, further studies on Kawainui Swamp, and a small snagging project on the Iao River on Maui.

The Flood Control Act of 17 May 1950 had authorized investigations of Iao Stream, Maui; of Kaunakakai Gulch, Molokai; and of Palolo and Manoa Valleys on Oahu. In addition, a House Public Works Committee resolution in July 1949 had called for a study of Waimea River, Kauai, while another resolution in August 1950 authorized the investigation of Kauai's Wailua River Basin, containing the Territory's one navigable waterway. The general curtailment of funds in the early 1950's postponed further work on these studies, however. The unfavorable report submitted in 1952 on Kaunakakai Gulch apparently represented the only study of new projects completed during the Korean War. In January 1953 the South Pacific Division Engineer lamented the Federal Government's inability to match local flood control endeavors, for the Territory then had under construction a flood protection program worth over $4 million. Even a year after the conflict ended, in December 1954, the Area had no Federal flood control projects under construction.

Some preliminary work continued on plans for the two previously authorized flood control projects. A general design memorandum for Hanapepe River was completed in 1956, after sufficient funds were finally appropriated, and the construction contract was awarded in June of 1959. Neither the project for Hanapepe nor that planned for Kawainui Swamp received Federal appropriations for fiscal year 1957. Progress on the Kawainui project resembled the development of plans for Kawaihae Harbor during the same decade; in both cases much time elapsed between authorization and construction, and in both cases the Territory went ahead with its own plans, which were to dovetail with the eventual Federal project. In 1954 the House Appropriations Committee deleted a proposed allotment of $500,000 for Kawainui because the Congressmen believed the project would contribute more toward land reclamation near the swamp than toward the flood protection of Kailua. Enraged residents of Kailua protested but could not persuade Congress to appropriate additional funds for the swamp project at that time. Meanwhile, just as the Territory constructed a small channel and basin at Kawaihae while awaiting construction of the Federal harbor project, so at Kawainui the government of Hawaii built an emergency flood outlet along the alignment of the proposed Federal channel after a heavy flood in 1951. In spite of this action, a continued scarcity of funds and a new debate over the intended use of the adjacent area postponed construction of the Federal project at Kawainui Swamp until the 1960's.

The Area's third flood control project, that for Wailoa River near Hilo, was authorized by the Flood Control Act of September 1954 and, like the project for Kawainui Swamp, was constructed in the following decade. In addition to the small flood control project completed in December 1950 at Kaunakakai Stream, Molokai, the Honolulu Engineers performed one other flood protection task while functioning as an Engineer Area. Section 13 of the 1946 Flood Control Act had authorized allotments of under $1 million in any one fiscal year for the removal of accumulated snags and other debris from navigable streams and tributaries, providing not over $50,000 was spent on any one tributary in a fiscal year. Under these terms, in fiscal year 1955 the Area completed a snagging and clearing project on the channels of Iao Stream, Maui, at a cost of $46,410. Only small jobs authorized by special provisions of the Flood Control Act, then, saw actual construction in Hawaii during the Area years. These projects and further plans for protection at Hanapepe and Kawainui thus constituted the Honolulu Engineer's major flood control activity between 1950 and 1957.

During this period the Honolulu office took up a new field of civil works, the control of beach erosion. Hawaii's geography once again shaped HED's civil works programs: whereas the work of many mainland Districts centered on the improvement of navigable waterways such as the Mississippi and the Missouri, in Hawaii "river and harbor" activity meant improvement of the island's vital ports. In the same way, whereas the width and length of the continent's major rivers required many districts to employ large dams and other massive flood control devices, the Honolulu District's flood protection projects on considerably smaller streams usually involved levees and outlet channels. Conversely, although districts located inland on the mainland had little to do with the control of eroding sand, Hawaii's many miles of shoreline required much attention by the Engineers to prevent beach erosion.

The increase in tourism in Hawaii after World War II created great interest in the islands' shores and led to increased efforts by local agencies to begin a program of beach erosion control. In fact, as early as 1919 a local journalist expressed concern over "the lessening area available . . . of this much-heralded Honolulu attraction (Waikiki),"[2] and a month later an editorial urged Uncle Sam to take over the Waikiki reclamation project begun by the Territory of Hawaii.[3] In 1926 a Honolulu engineer proposed enlarging the beach frontage at Waikiki by erecting groins to hold the drifting sands.[4] These early cries for beach erosion control at Waikiki served as background for the studies later performed by the Honolulu Engineers. In 1930 the U.S. Army Engineer Beach Erosion Board was established, and under the provisions of Public Law 727, 79th Congress, the Federal Government was authorized to participate in construction costs for protection against erosion up to the limits of one-third of the cost. The 3 July 1930 River and Harbor Act had authorized a cooperative study of the beach at Waikiki; in January 1940 Major Bermel urged local interests to provide the necessary funds to match Federal appropriations for an initial survey. Beach erosion protection followed the same route as did flood control, however, and did not begin as a Federal program in the Territory until World War II had ended and vacationers had rediscovered Hawaii.

In 1948, then, after the Territory requested Federal aid to improve the public sections of Waikiki Beach, Colonel Falkner undertook a survey of the area under the authority of the 1930 River and Harbor Act. The District Engineer held public hearings in June 1949 and January 1950, and in December 1950 he reported favorably on a plan for restoring the beach from the Natatorium to the southeast boundary of Fort DeRussy. The River and Harbor Act of 3 September 1954, which authorized the Kalihi Channel to Honolulu Harbor and the enlargement of the harbor at Nawiliwili, also approved of Federal participation in the project for the protection and improvement of Waikiki Beach. The end of the Korean War thus brought increased activity in beach erosion control as well as in navigation improvements.

In 1951, meanwhile, the Territory had begun construction of the Waikiki project, which comprised

the artificial placement of suitable sandfill to widen the beach berm to widths of 75 to 150 feet; and the construction of 1,200 feet of terrace wall, two groins, and appurtenant drainage facilities. The groins and 800 feet of the wall were to be deferred until their need was proven as the project progressed. Construction was completed in October 1957; in 1960, the Engineers contributed $214,356, or one-third of the first cost of improvements.

Waikiki Beach, Oahu, looking north, 1970.

This project to widen the beach at Waikiki marked the Honolulu Area's entrance into the field of beach erosion control. The work done in the 1950's did not completely prevent erosion on Oahu's south shore: two years after this job was finished, 18,700 cubic yards of sand were required to nourish the project, while the plans discussed in Chapter IX represent a more recent attempt to widen and protect the beach at Waikiki. Nor was HED's shore protection activity even in the 1950's limited to beaches on Oahu. In December 1955 the Area issued a favorable report following a cooperative study of erosion of the shores at Waimea Beach and Hanapepe Bay, Kauai. The next year the Beach Erosion Board and the Chief of Engineers both approved the plans, and in 1958 the River and Harbor Act authorized the two projects. The Federal Government may participate by contributing up to one-half of the first costs of protection of the publicly owned sections of the shore; the project provides for the construction of rubblemound seawalls, 1,240 feet long and with a top elevation of 11 feet at Waimea, and 1,525 feet long with a top elevation of 14 feet at Hanapepe. As of 1 July 1969, the project at Waimea was authorized for construction by the State but work had not begun, while State construction of the seawall at Hanapepe had been deferred indefinitely because of excessive bids.

Beach erosion control thus joined flood protection and navigation improvements as part of HED's civil works program in the 1950's. In all three areas, work remained at a low level for the first few years of the decade and then picked up slightly as new funds became available around 1954. To some extent the same pattern also characterized military construction during the Area years. Just as the end of the Korean War enabled Congress to appropriate more money for civil works activities, so the armistice prompted a boom in military construction projects around 1955. A February 1955 issue of the **Honolulu Advertiser** headlined a new housing project planned for Schofield Barracks;[5] an article in the **Star-Bulletin** in June of that year discussed an anticipated $5 million Air Force construction program for Hawaii.[6] Confirmation of these proposed projects came in September 1955, when Lieutenant Colonel Shelley announced a $4.5 million program to replace Hickam's airfield pavements and a $3 million outlay expected for housing at Schofield Barracks. Jobs at Wheeler, Bellows, and Helemano were also included in the $10 million building program for Oahu's military installations. By March 1956 approximately $41 million worth of Army and Air Force construction was authorized or programmed in the Territory of Hawaii. The rise in military construction after and as a result of the Korean War was even more marked than the slight increase noted in civil works activity at the same time.

During the war, too, military construction in Hawaii did not experience as definite a lull as did the Area's civil works program. Work did slow down slightly because of the war: in the spring of 1953 the Area was instructed to halt all bidding on the joint underground gasoline storage system rehabilitation, for example, and in July of that year the San Francisco District temporarily suspended all work on the restoration of two buildings at Hickam, in order not to exceed authorized funds. Yet even in the period from 1950 to 1954, several new military construction projects saw authorization and actual construction. In fiscal year 1953, for instance, engineering for Army and Air Force projects in Hawaii totaled over $9 million — a small sum compared to the $41 million programmed in 1956, but a large amount compared to the less than $2 million authorized at this time for civil works construction in the islands. Both civil works and military construction projects in the Honolulu Area felt the effects of the Korean War, that is, but the military program suffered fewer symptoms of the slowdown than did civil works.

Many of the military facilities rehabilitated or built in the first three years of the decade, as well as some of those constructed after 1954, were at Hickam and Johnston Island Air Force Bases. At Hickam, one of the first sets of buildings to be rehabilitated included six two-story bachelor officer quarters units on Block 18 and eight temporary barracks buildings on Block 61. Soon after the contractor began to replace the floors of the wooden structures, in the spring of 1953, workers discovered extensive, unexpected termite damage in Block 18. Additional funds were transferred from other projects and the contractor proceeded with the rehabil-

itation, which cost just over $300,000. Contractors installed supporting utilities and rehabilitated a mess hall at Hickam at the same time. Similar repairs to an airmen's dormitory were made soon after the Korean War at a cost of $632,782, while a cargo pier at Hickam was also rebuilt by contract between 1955 and 1957. Most new work at the Air Force base awaited the end of the Korean conflict. By late 1957 the Area had supervised the construction of a cold storage building and the erection of an electrical switching station at Hickam.

The program of military construction for fiscal year 1953 included a series of navigation aids at the air base. A UHF radio air/ground facility, a UHF direction finder, a radar homing beacon, and a tactical ground control approach facility topped the list of aids to be designed and built during 1953. The same year also saw considerable work performed on fueling and storage systems, including the installation of a hydrant gasoline fueling system at Hickam at a cost of approximately $615,000. The Ralph M. Parsons Company meanwhile completed an inspection report on the rehabilitation of the joint underground gasoline system, which extended from Kipapa Gulch through the Waiawa Pump Station to Hickam dock. Another project which included work elsewhere on Oahu as well as at Hickam was the construction of a global communications system with installations at Bellows Air Force Base, Haiku Naval Radio Station, Wheeler Air Force Base, and Hickam. In early 1958 the District paid over $1.5 million to Hawaiian Dredging Company for the construction of communication relay center facilities, a transmitter and transmitter power facilities, and a standby power plant as part of the Globecom project.

The rehabilitation of existing structures and the construction of new buildings at Hickam paled in significance when compared to the extensive airfield reconstruction projects completed during the Area years. A pavement evaluation made in May of 1952 revealed that none of the existing runways, taxiways, or aprons at the air base met then-current criteria for airfield pavements. Thus in early 1953 contractors began to strengthen the pavement of the parking apron at Hickam. Although some urged overlaying most of the pavement and excavating only those portions where distress had occurred, the Area contracted for the demolition and replacement of the entire subgrade pavement. A debate over the economic advantages of asphaltic concrete versus the benefits of Portland cement concrete for the pavement surfacing was resolved in favor of the less expensive asphalt cement. The apron reconstruction project cost over $3 million.

Airfield repaving at Hickam continued after the Korean War under a $4 million program which included the rehabilitation of the airmen's dormitory and the installation of fuel storage facilities as well as the reconstruction of the pavement at the air base. By this time the runways and taxiways needed rebuilding, for the new, heavier jet bombers put great stress on the 20-year-old field, while jet fuel spillage was damaging the pavement surface. Largest of the contracts let for this project was the one awarded in December 1955 to James W. Glover, Ltd., for $2.9 million. On 30 September 1957 the contractor completed the reconstruction of the airfield pavement.

During these years many of the facilities constructed at Hickam Air Force Base were duplicated at Johnston Island, which the Navy had transferred to the Air Force in 1948. In yet another illustration of the Honolulu Engineers' wide geographic jurisdiction, by January 1951 the Area had established a project Office at Johnston Island, 700 miles southwest of Hawaii. The staff of approximately 20 was enlarged at the end of 1954 to handle increased postwar construction. Among the first projects begun by the Engineers at Johnston Island were the construction of four two-story family quarters units and a one-story residence for the base's commanding officer; the resurfacing of the aircraft runway, parking area, and taxiway; and the partial rehabilitation of a sewer system and improvements to water and power utilities system. The cost of this program, started in 1951, was approximately $2.5 million.

The second stage of construction at Johnston Island began in the spring of 1953, when plans were approved for the construction of two barracks and a mess hall to house and serve 396 airmen. The new program drawn up in 1954 also included the construction of an administration building, a warehouse, new shop buildings, and additional family housing. And Johnston Island, like Hickam, saw several navigation aids constructed in the early 1950's: in 1953 work started on a UHF air/ground facility, a UHF direction finder, and a radar homing beacon. In one respect the Engineers' work at Johnston Island differed from their activities at Hickam, for in addition to its military construction program at Johnston, the Area was also responsible for a harbor development project at the island base. Planning in 1951 preceded bid advertising in 1952 for the rehabilitation of existing finger piers and a small boat dock, the construction of a concrete revetment for slope protection, and the replacement of a tide gauge shelter. Even in these relatively slow years, the Honolulu Engineers maintained a construction program on an overseas island in the Pacific.

In addition to these jobs performed for the Air Force, the Honolulu Area also handled military construction for the Army in Hawaii. Between 1951 and 1953 the Engineers erected a new three hundred-man barracks and designed plans for a direction finder station at Helemano, for example. Schofield Barracks also saw some activity during this period, although construction of the enormous housing program planned for that post did not begin until 1957. In 1955 contractors designed an enlisted men's club which was constructed at Schofield by contract between September 1956 and November 1957 at a cost

of approximately $500,000. Design for a 1,326-unit Capehart housing project at Schofield was completed by contract in 1956, while similar Capehart projects were planned at the same time for Tripler Hospital and Fort Shafter.

Housing became an increasingly important part of the Area's military construction program in the mid-1950's, in fact, since most housing construction had been suspended during the Korean War. In addition to the quarters built at Hickam, Johnston Island, and Helemano, a small family housing project was constructed at Waipio, Oahu, between January and October of 1957, and the Capehart housing jobs planned for Schofield, Tripler, and Fort Shafter would see construction within the next few years. Like most other military construction projects, Hawaii's housing program expanded at the end of the Korean War.

Whereas both civil works and military construction experienced some cutbacks between 1950 and 1953 and then began to pick up later in the decade, real estate activities followed a different pattern. The real estate office did shrink in size between 1950 and 1954, as did most of the Honolulu Area. After the Korean War, however, when other branches were expanding slightly, real estate retained a relatively small staff. The pace of the real estate program during the Area years no doubt stemmed from the nature of that unit's work. Since the bulk of real estate transactions still concerned property disposal, and since most of the lands occupied during World War II had been returned by 1950, real estate's activities declined rather than grew in the 1950's. The workload of the real estate office during this decade thus rose or fell in reaction to the effects of World War II rather than in response to events in Korea.

The size of the real estate branch decreased gradually from 1950 to 1957. In January 1950 almost one-third of the District's employees worked in the real estate office; two years later, when the Area staff had grown to between 160 and 180, the Real Estate Division employed less than 25 of these. That number had decreased to 17 by January 1953 and to 15 a year after that, while the Area office suffered similar cutbacks. Even after the Area began its postwar growth, in July 1956 and January 1957 real estate employees numbered only fourteen. Although property transactions continued to play an important part in the history of the Honolulu Engineers, the real estate office remained a small unit compared to its status immediately after World War II.

Among the pieces of property returned during the Area years were several airfields in Hawaii. In the fall of 1951 the Army and the Territory agreed on the terms of the return of Hilo Airport, by then named General Lyman Field after the late District Engineer. Nearby land at Waiakea was also to be returned. Negotiations for the transfer of smaller airfields on the outer islands continued into 1950 as debate over the exact wording of the contracts was resolved. Portions of many of Oahu's military posts were also the subject of real estate transactions during this decade. In June of 1950 a 2.892-acre parcel at Fort Armstrong was transferred from the military reservation to the jurisdiction of the Chief of Engineers, while a smaller area of 1.66 acres was transferred from the jurisdiction of the Chief of Engineers to that of the Commanding General, U.S. Army, Pacific (USARPAC), as part of the military reservation. In 1952 a Presidential executive order returned two tracts of land at Fort Armstrong to the Territory. The local government was to replace the few Engineer buildings located on one of those tracts before the transfer would become effective.

Various sections of Fort Ruger likewise were released between 1950 and 1957. In 1952 the Army turned over the post theater to the Honolulu Community Theatre's directors, who had been looking for a "home" for their productions. HCT still uses the Fort Ruger Theater on the slopes of Diamond Head Crater. More significant, perhaps, was the 1955 agreement between the Army and the Territory of Hawaii concerning 595 of the 675 acres at Fort Ruger. Approximately 125 of the 595 acres were transferred to the Territory for unspecified purposes, while the remaining 470 acres were restored for the specific use of the Hawaii National Guard. In 1956 the Territory also received approximately 38 acres at Fort Barrette and a small portion of land at Fort DeRussy.

Disposals dominated the real estate scene in the 1950's, then. One example of property acquisition involved approximately 35,000 acres of Territorial land on the Big Island and another 4,000 acres on Oahu which the Army hoped to utilize for training purposes. The end of the Korean War and the return to Hawaii of the 25th Infantry Division created a demand for training sites as well as a need for housing units and thus influenced the work of the Real Estate Division as well as that of the Area's construction forces. To the real estate office fell the difficult task of negotiating with the Territorial government the rights to this valuable land. Revocable permits and long-term leases were among the real property arrangements considered in late 1955 and 1956.

Most real estate transactions in this period attracted little interest among local residents, but the Engineers' sale of surplus buildings at Hickam in 1954 did cause some consternation. Declared high bidder in April 1954, Tajiri Lumber and Supply Company was to pay the U.S. Government $16,860 for permission to demolish and remove the 108 wooden structures at the air base. Announcement of the contract award inspired cries of outrage from a local citizen who styled himself as "Chief of Operations, Society of Men of War," and who wrote the **Honolulu Advertiser** to object to this cheap disposal of valuable Federal property. The newspaper took up the resident's story and likewise complained that over one million board feet of lumber had apparently been sold "for the price of a five room cottage."

The Area Engineer quickly clarified the terms of

the transactions for local interests: only 729,480 feet of the lumber were salvageable, and that amount was worth only $42,000; $45,768 would be required to restore the buildings to usable condition; thus, if the Government were to attempt to salvage the structures, Uncle Sam would have to pay almost $4,000. Instead, Lieutenant Colonel Shelley explained to the **Advertiser**, in accepting Tajiri's bid the United States would recover $16,860. One of the unsuccessful bidders joined the Area Engineer in approving the Government's award of the contract, and a subsequent **Advertiser** editorial likewise acknowledged the wisdom of the Army's transaction.

Far from pacified, however, was the "Chief of Operations, Society of Men of War," who continued to write to Lieutenant Colonel Shelley, to the **Honolulu Advertiser**, and, finally, to Lieutenant General Samuel D. Sturgis, Chief of Engineers. While the Area staff may have laughed at the writer's idiosyncracies, the Chief of Engineers expressed understandable concern and demanded an explanation from the South Pacific Division Engineer. Lieutenant Colonel Shelley's requests for information from USARPAC revealed that local Army officials considered this gentleman "a crackpot" who exhibited strong "symptoms of megalomania" and whose previous letters to various military and government leaders had officially been ignored. Lieutenant Colonel Shelley quickly assured the Division Engineer and Lieutenant General Sturgis that no one in Honolulu took the "Society of Men of War" seriously, and the Office of the Chief of Engineers agreed to drop the matter.[7]

Not all of the Engineers' real property negotiations in the 1950's were routine, then, although by the end of this period real estate functions were resuming normal conditions. As long as the Honolulu Engineers remained an Area Office under the San Francisco District, the real estate branch carried Division status in the Corps and reported directly to the Chief of Engineers. When the Area was redesignated a district under the Pacific Ocean Division on 1 July 1957, real estate matters returned to the jurisdiction of the District and the new Pacific Ocean Division. By 1955 approximately 90 per cent of the land which had been under Army and Air Force control ten years earlier had been returned to the civilian economy; by 1956 the Real Estate Division had closed its office of alien property. Although real estate activities would continue throughout HED's entire history, by 1957 this branch had fulfilled most of its disposal duties arising from World War II.

As the real estate office concluded many of its postwar functions and decreased in size during this period, then, the other branches of the Area were experiencing gradual growth as they recovered from the temporary cutbacks of the decade's early years. The significance of the Area epoch lay perhaps in the background these years provided for future HED projects. The limited construction which took place between 1950 and 1957 revolved primarily around Kawaihae Harbor in the area of civil works and around airfield and housing projects in the military field. Yet this period also saw the authorization of Honolulu's second entrance channel, which would be dredged at the start of the next decade, and detailed plans of flood control projects for Hanapepe River and Kawainui Swamp, where improvements would appear in the 1960's. The Engineer's participation in a cooperative beach erosion project for Waikiki in the 1950's served as background for further studies in the same area ten years later, while the study of tsunami protection for Hilo was a prelude to model testing beginning in 1964. Even the rehabilitation of the Kahului breakwater with tetrapods could be seen as a harbinger of the Nawiliwili breakwater reconstruction which utilized precast tribars. In the area of military construction, too, the design of Capehart housing for Schofield, Tripler, and Fort Shafter would prove only the introduction to a new chapter in HED's history as the Honolulu Engineers embarked on major Capehart projects in the next few years.

Together, the period from 1945 to 1950 and the Area years from 1950 to 1957 represented a quiet era for HED, just as the decade of the 1920's delineated an earlier epoch of relatively little activity. The 1920's marked a lull before the storm of the 1930's, when PWA, WPA, and the Midway harbor project transformed the quiet District into a bustling Federal agency. In the same way, the years from 1945 to 1957 formed a flexible springboard from which the increased activity of the early 1960's would launch HED into a new and exciting era.

Footnotes — Chapter VIII

1. Honolulu Area Engineer to San Francisco District Engineer, 13 April 1954, in U.S. Army Engineer Area, Honolulu, files stored at Federal Records Center, St. Louis.
2. Thrum, 1919, p. 130.
3. **Paradise of the Pacific**, January 1920, p. 3.
4. Thrum, 1927, pp. 127-128.
5. U.S. Army Engineer District, San Francisco, **The Parapet**, 1 March 1955, p. 3.
6. The **Honolulu Star-Bulletin**, 30 June 1955, p. 1, col. 3.
7. Miscellaneous correspondence in U.S. Army Engineer Area, Honolulu, files stored at Federal Records Center, St. Louis; **The Honolulu Advertiser**, 21 April 1954, p. A4, col. 1; 24 April 1954, p. A4, col. 5; 27 April 1954, p. A4, col. 1.

CHAPTER IX: Rebirth

With the reestablishment of the Honolulu Engineer District and HED's transfer to the new Pacific Ocean Division in 1957, the Honolulu Engineers entered a decade of increasingly exciting endeavors. Civil works activities in this period focused on the construction of the bascule bridge over Honolulu's second entrance channel, on tsunami studies at Look Laboratory, and on the reconstruction of the breakwaters at Nawiliwili and Kahului. Highlighting military construction between 1957 and 1965 were several large Capehart projects for the Army, the installation of Nike-Hercules batteries at various sites on Oahu, and extensive work performed in connection with the Nike-Zeus and Nike-X programs in the Marshall Islands.

The diversity of work characteristic of the District's entire history and especially notable in World War II was also a feature of this era. In 1961, for instance, the Honolulu Engineers were supervising the construction of the bascule bridge, studying plans for small boat harbors, and designing new beach erosion projects for Waikiki and Haleiwa — while at the same time presiding over the completion of Air National Guard facilities at Hickam, working on Nike-Hercules launch pads on Oahu, and meeting the challenge of an intensified construction program at Kwajalein. As in the Second World War, too, many of the projects of these years introduced the Honolulu District to new experiences. Never before had HED reconstructed a breakwater with precast tribars, built a bascule bridge, or generated tsunami waves in a 4,000-square-foot model. Construction of radar facilities at Kwajalein and launch pads there and on Oahu also demanded new techniques, while the Marshall Islands' humid environment further taxed HED's ingenuity. The District's responsibility for military construction in the Trust Territory of the Pacific also recalled the Engineers' wartime expansion to the South Pacific islands. Although even in the busy years of 1960 and 1961 HED's workload did not approach that of World War II, on a smaller scale this period resembled the war era in diversity, in novelty, and in geographic scope.

The redesignation of the Honolulu Area Office as the Honolulu Engineer District took effect on 1 July 1957, one month after the establishment of the Pacific Ocean Division (POD) in Honolulu. At that time HED's jurisdiction extended only to the Hawaiian and Johnston Islands, but in December 1957 the District's limits were expanded to include the Line, Gilbert, and Marshall Islands plus Midway and Wake. HED retained responsibility for all these islands until August 1964, when the District's jurisdiction was limited to Hawaii and the Marshall Islands. In the meantime, in January 1963 HED added to its duties certain civil works activities in Guam.

Just as Colonel Falkner served as District Engineer until 31 July 1950 and then as Area Engineer for another year, so Lieutenant Colonel Hatch remained in charge of the Honolulu Engineers when the office returned to district status in July of 1957. Lieutenant Colonel Hatch and his executive officer, Captain Maurice D. Roush, later received commendation ribbons for their meritorious service with the Honolulu District from 1957 to 1959. Colonel John R. Clifton presided over HED from June 1959 to June 1961, during this era's most rapid growth, and was succeeded by Colonel Donald G. Williams and then, in July 1963, by Colonel Glenn P. Ingwersen. Awarded the Legion of Merit for his outstanding services as District Engineer was Colonel William F. Roos, who served from June 1966 until his retirement in August 1968. His Deputy District Engineer, Lieutenant Colonel C. S. Romedy, was then appointed Acting District Engineer. Colonel John A. Hughes has been Honolulu District Engineer since November 1968, Throughout the entire period HED continued its cordial relations with local interests and on at least two occasions drew expressions of appreciation from Governor William F. Quinn. The efforts of Honolulu's District Engineers as well as the progress made in the 1960's on flood control, beach erosion protection, and small boat harbor projects in the State contributed greatly to the Engineers' fine reception by the people of Hawaii.

HED's transfer to the Pacific Ocean Division signaled a new situation for the District, for until this time the Honolulu office had always reported to an Engineer Division located 2,400 miles away on the west coast of the mainland. Now HED's command Division had its offices not merely in the same town but actually in the same building, as POD employees occupied the third floor of Fort Armstrong's Building 96. This arrangement opened the door to new relationships between Division and District.

Aloha Week festivities and other holiday cele-

brations naturally included employees of both POD and HED, while the office newspaper initiated in the fall of 1957 was named **POD-HED Patter** and covered activities of both the Division and the District. Administrative functions also tended to merge. A light POD workload in 1958 first led the Division to consider combining the two organizations; a similar slowdown in 1962 prompted further consideration of a merger. In that year OCE accepted POD's recommendation that the offices of the Comptroller, the Office Service Branches, and the Real Estate Divisions be consolidated. Effective 1 July 1962, then, those units of the District were abolished and their functions transferred to the corresponding sections of the Division, from where they would continue to service HED. Officially directed in order to adjust to a reduction in POD's workload, the reorganization of 1962 also corresponded to lighter activity in the District. In mid-1962 Honolulu's bascule bridge had just been finished, major Capehart housing projects were nearing completion, and Nike-Zeus facilities at Kwajalein had been constructed and were ready for testing. To consolidate POD and HED functions even further, in January 1963 the District's supply section was transferred to the Division. This arrangement lasted only until October 1963, however, when District supply functions were returned to HED. POD's Office of the Comptroller, Office of Administrative Services (Office Service Branch), and Real Estate Division have continued to provide support services to the Honolulu District. The consolidation of these three units and talk of combining POD and HED in 1962 heralded plans formulated in 1970 for the complete merger of the Division and the District.

The slight dip in activity in 1962 represented one of several fluctuations in the District's workload between 1957 and 1965. The increase in activity first noted after the Korean War continued for several years: in 1955 the Area let 6 military construction contracts; in 1956, 4; but in 1957, 21, and in 1958, 23. Twelve of the 21 contracts awarded in 1957 and 4 of the 23 signed in 1958 were for Capehart housing units at Schofield, Tripler, and Fort Shafter. This continued growth reached a peak in 1961, when HED placed $67 million worth of military construction and an additional $1.3 million in civil works. Nike-Zeus construction made up much of the military construction of that year, and the temporary lull in the Kwajalein program the following year was partly responsible for the drop in HED's overall activity in 1962, when $33 million worth of military construction and $2.9 million in civil works projects were placed. Reduced Congressional appropriations may also have contributed to the slight slowdown in 1962: in June of that year the Senate Armed Services Committee found "no urgent valid requirement" for proposed projects at Fort DeRussy and Bellows Air Force Station, while in September the District received word that the Senate had halved a Department of Defense request for funds for nationwide military housing.

Also indicative of the varying workload between 1957 and 1965 was the shifting size of the staff of the Honolulu District. Whereas in 1955 the authorized strength of HED totaled only 94, by March of 1960 this figure had risen to almost 250. The number of HED personnel decreased slightly in 1962 and by 1967 had stabilized at around two hundred civilian employees and 10 military men. These relatively minor fluctuations in workload and personnel should not obscure the overall trend toward growth and expansion which HED experienced between 1957 and 1965. Because these years saw so many new activities, and because so many of these jobs have continued into recent times, separate sections of this history will deal with civil works and with military construction. The remainder of this chapter covers navigation projects and small boat harbors from 1957 to 1965, the tsunami studies at Look Laboratory, and flood control and beach erosion protection activities in Hawaii. In the following chapter, then, are discussed this period's major military construction projects, which included Capehart housing and Nike-Hercules batteries on Oahu plus Nike-Zeus and Nike-X facilities in the Marshall Islands. Together, these two chapters depict the new era of adventure experienced by the Honolulu Engineer District since 1957.

All of Hawaii's major islands and even tiny Molokai received Federal river and harbor improvements between 1957 and 1965. On Kauai, dredging operations and breakwater construction focused on the port of Nawiliwili. In 1959 the Government dredge **Harding** excavated an area on the north side of the entrance channel, while the following year contract plant dredged a similar spot on the south side, to complete the existing project at Nawiliwili by 30 June 1960. Around the same time, plans began for the reconstruction of the breakwater, which had been damaged by the storms of March 1954.

The Nawiliwili breakwater rehabilitation attracted nationwide interest because of the District's use of 17.8-ton tribars. Designed by HED civil engineer Robert Q. Palmer, these concrete units consisted of three cylindrical bars whose strength when placed on the barrier's slopes would break up heavy ocean swells. The first tribar was cast in mid-September 1958 and was then christened by Mrs. Clifford Davis, wife of the Tennessee Congressman serving on the House Committee on Public Works. By 17 December 1958 almost all 600 tribars had been cast and by 13 January 1959, 473 of these had been placed on the breakwater slopes.

Good weather facilitated the completion of the breakwater reconstruction several months ahead of schedule; in February 1959 Hawaiian Dredging and Construction Company placed the final tribar, finished the small light tower at the outer end of the breakwater, and completed the reconstruction for a total contract price of $921,532. Within the next year Mr. Palmer had received a Federal patent for his rubblemound breakwater component and the Ha-

waii Section of the American Society of Civil Engineers had chosen the Nawiliwili Harbor breakwater as the outstanding engineering contribution and achievement for 1959. Mr. Palmer's article on "Breakwaters in the Hawaiian Islands" was published in the June 1960 **Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers**, and earned acclaim for both the author and the Honolulu District. For the Nawiliwili breakwater repair and other projects he supervised during his 12 years with HED, Mr. Palmer was honored in early 1970 as the District's first Distinguished Civilian Employee. The necessity of repairing the Nawiliwili barrier and the scarcity of suitable rock near the harbor had introduced HED and the engineering world to a new feature in breakwater construction.

Other harbor work on Kauai since the reestablishment of the District included studies at both Nawiliwili and Port Allen. A House resolution dated 3 June 1959 authorized a review of reports on Port Allen to determine the advisability of constructing a second breakwater to reduce surge and beach erosion at adjacent Hanapepe Bay. In November 1966 this study was combined with the investigation of Nawiliwili Harbor, authorized by resolution in October 1966, to determine the feasibility of enlarging the harbor and easing the entrance channel bend. As of 1 January 1970 the combined study remained in survey status.

Harbor construction and investigations took place on Oahu as well as on Kauai between 1957 and 1965. At Honolulu, attention focused on the dredging of the long-awaited Kalihi Channel and the construction of the bascule bridge, first of its type to be built in the islands. After four decades of discussion, this modification of the Honolulu Harbor project had been authorized in September 1954. Now, in May 1959, Mr. Roy Jorgensen became the first Resident Engineer for the project and on 9 October of that year a dedication ceremony commemorated the start of construction. Hawaiian Dredging and Construction Company held the contract for dredging the inner portion of the harbor entrance; a mainland firm was to build the substructure of the bridge; and Hawaiian Dredging and Construction in a joint venture with J. H. Pomeroy and Company would then construct the bridge superstructure across the new channel.

When in June 1959 the Portland District's hopper dredge **Harding** began dredging the outer portion of the channel, the **Honolulu Advertiser** described the "mottled, disturbed sea" which "gave up ageless chunks of its coral paved bed yesterday as a giant vacuum cleaner swept an area which will eventually provide Honolulu harbor with its Second Entrance channel."[1] That fall, soundings in the channel revealed a number of high spots too hard for dredging, and the 14th Naval District sent its "frogmen" to blast these hard areas with submarine dynamite. By July 1960, when dredging operations were completed, over 300,000 cubic yards had been excavated in the outer portion and over 1.1 million cubic yards removed from the inner portion of the channel.

Tribars placed on the breakwater at Nawiliwili Harbor, Kauai.

As the dredging progressed, work began on the construction of the bridge's substructure. A 24 hour period in December 1959 saw approximately 2,000 cubic yards of concrete poured in the first main pier. Pours continued throughout 1960 until September, when the concrete crib seal in Pier 4 was not accepted by the Government and 22-inch diameter holes had to be drilled through the concrete for the placement of prestressed concrete piles in the hard coral below. The tsunami of 23 May 1960 also inflicted some damage and required a temporary halt in construction. By late 1960 the two huge abutments which would support the bridge structure stood above the water like concrete monuments visible from the shore. A successful tremie pour took place over a weekend in October 1960 to complete the concrete seal in Pier 3, and work proceeded that December on pouring and reinforcing the subsurface enclosure which would house the bridge control mechanisms. By May 1961 Piers 3 and 4 extended 23 feet above the water, cables had been laid in the submarine trenches, and the substructure was essentially complete.

Major Roy C. Beatty and Captain David D. Hall supervised the final stages of the construction of the bridge from their Sand Island office. The pouring difficulties experienced in 1960 created a one year delay in the subsequent construction of the super-

Honolulu Harbor, looking southwest, 1970. Sand Island lies in the center of the photograph and is divided on the north from the Honolulu waterfront by the Reserved Channel, which leads on the southwest to Kapalama Basin and Kalihi Channel, crossed by the Slattery Bridge.

structure, which was completed by contract in the spring of 1962. Although the contractors had yet to remove 100,000 cubic yards of the old causeway, on 24 April 1962 the first motorists drove across the bascule bridge between Kapalama Basin and Sand Island. Dedication ceremonies on 22 May officially opened the Kalihi Channel and the John Rudolph Slattery Bridge, named for Honolulu's first District Engineer. After Miss Virginia Vilmaire unveiled the plaque honoring her uncle, Colonel Slattery, over 200 guests rode the Coast Guard cutter **Matagorda** on the first voyage around Sand Island. The Slattery Bridge then took its place as the nation's fourth largest bascule bridge in terms of long, clear-channel openings. The substructure and superstructure of the bridge had cost over $3 million and the channel itself another $1 million. The State provided for roads and utilities on Sand Island so that additional wharfage space could be developed there, and in July 1962 the State government formally assumed responsibility for the operation and maintenance of the bridge. Although the main entrance channel would continue to carry most of the harbor's commerce, since that entrance was wider and afforded a shorter route to deep water, the Kalihi entrance would be used in times of heavy traffic and whenever vessels might block the main entrance. The second entrance channel to Honolulu Harbor, first considered in 1913, became a reality almost half a century later.

Even this westward expansion did not complete Honolulu Harbor's potential growth, for while contractors dredged the Kalihi entrance channel the Engineers were already investigating another modification of the project for Honolulu. A resolution of the House Committee on Public Works of 19 July 1956 had authorized a survey of Honolulu Harbor with a view to deepening the main (Fort Armstrong) entrance channel to 45 feet and deepening the harbor basin and Kapalama (Reserved) Channel to 40 feet. A second resolution of 14 August 1959 called for consideration of deepening Kalihi Channel, then being dredged to 35 feet, to a greater depth. The two studies were combined with an investigation of a possible deepwater port at Barbers Point on Oahu and field work on the study began in May of 1961. A public hearing held that September indicated local support for the improvements at Honolulu. Autho-

rized by the River and Harbor Act of 27 October 1965, the project modification provides for deepening the seaward 3,600 feet of the main entrance channel to 45 feet; removing a narrow strip from the northeast corner of Sand Island; deepening the main harbor basin and Kapalama Channel to 40 feet; widening Kapalama Channel by 60 feet along the Sand Island side for 3,100 feet; and relocating the project limits in the harbor. As of December 1969 the recommended modification was in the design memorandum stage and estimated total first costs were over $5 million, including approximately $2.5 million in non-Federal costs. This projected expansion of Honolulu Harbor once again exemplified the gradual, step-by-step growth characteristic of most of Hawaii's deep-draft ports.

Meanwhile, these studies of Honolulu Harbor had been combined with an investigation of the need for a deepwater harbor at Barbers Point. Extensive industrial growth on Oahu's leeward shore led in July 1958 to a House Committee on Public Works resolution calling for a study of a second major port for Oahu. The River and Harbor Act of 27 October 1965 then authorized the project for Barbers Point along with the expansion of Honolulu Harbor.

The project provides for a deepwater port with an entrance channel 3,100 feet long, 450 feet wide, and 42 feet deep; a harbor basin about 46 acres in area and 38 feet in depth; and two wave absorbers each 660 feet long. In addition, a light-draft harbor with a main access channel 1,200 feet long; 80 feet to 140 feet wide, and 12 feet deep and with an eventual berthing capacity of 1,200 boats would be located northwest of the deep-draft basin, just inside the entrance. Model testing by the University of Hawaii under contract began in 1967; model design was coordinated, with the U.S. Army Engineer Waterways Experiment Station (WES) in Vicksburg, Mississippi; and the design memorandum was completed in 1969. As of 1 July 1969 estimated total first costs were over $21 million. Construction of the deep-draft harbor at Barbers Point would make Oahu the third island in the State to have two major seaports and would no doubt divert more heavy industry from Honolulu to the leeward coast. A proposed inter-island ferry system might use the Barbers Point harbor as a docking site, while the port could also provide additional facilities for military installations on leeward Oahu. The small boat harbor meanwhile would relieve overcrowding at nearby Pokai Bay. Just as HED had responded to the Big Island's agricultural development by constructing the harbor at Kawaihae, so now the District would acknowledge Oahu's industrial growth by building a deepwater port at Barbers Point.

Concurrent civil works activities on the island of Maui focused on the enlargement of the harbor and the repair of the breakwater at Kahului. The River and Harbor Act of 14 July 1960 authorized the enlargement of the Kahului Harbor basin by an area 600 feet wide, 2,400 feet long, and 35 feet deep in the

Slattery Bridge, over Kalihi Channel, Honolulu Harbor.

west end of the basin at an estimated cost of just under $1 million. June of 1961 saw the start of dredging operations by the Hawaiian Dredging and Construction Company. Rough seas, solid coral beds, and the temporary breakage of a dredge delayed dynamite blasting, but by March 1962 the contractor had completed the enlargement except for the removal of one rocky shoal area. Actual cost of the modification was approximately $700,000. The completed project then consisted of rubblemound breakwaters on the west and east sides of the harbor, 2,315 and 2,766 feet long; an entrance channel 600 feet wide between the breakwaters; and a harbor basin 35 feet deep, 2,050 feet wide, and 2,400 feet long.

Ever since the harbor's initial construction in 1914, breakwater damage had necessitated frequent repairs at Kahului. In March 1959, for example, the District paid over $275,000 for the emergency repair of the barriers, which had been hit by storm waves a year before. Nor were such repairs unusual; the 1961 Annual Report cited an average annual maintenance cost over the previous five years of $267,736. In November 1961, then, as the contractor was completing the harbor basin enlargement, the District began preconstruction planning for a major rehabilitation of the breakwaters at Kahului.

The design memorandum was approved in fiscal year 1963 and plans and specifications for the first

phase of the breakwater rehabilitation were completed the following December. In 1956 the Engineers had used precast tetrapods to restore sections of the barrier at Kahului; in 1958 Mr. Palmer had developed 17.8-ton tribars for reconstructing the breakwater at Nawiliwili. Now in 1964 the District returned to Maui with techniques learned on Kauai and began the rehabilitation of the Kahului breakwaters with 35- and 50-ton tribars.

The contract awarded to Healy-Tibbets Construction Company of San Francisco in March 1964 called for the placing of Government stockpiled stones on the east breakwater and for the casting of 920 35-ton tribars and 172 50-ton tribars. A second contract signed with the same firm in January 1965 covered the placement of the tribars and the removal of the small shoal area in the harbor. The damage inflicted on the breakwaters by high waves on 29 January and 2 February 1965 required modifications to the first contract to provide for casting an additional 88 35-ton units and 43 more 50-ton tribars. Design failures of a stiffleg derrick crane and a center mast caused delays, and rehabilitation was completed in September 1966. At a total cost of approximately $1,600,000, 827 35-ton and 43 50-ton tribars had been placed on the east barrier while 181 35-ton and 173 50-ton units had been placed on the west barrier. In addition, 63 reinforced concrete ribs had been cast in place along the east breakwater crest and 3,000 tons of 5-ton minimum stone had been placed on the harbor side of the east breakwater near its seaward end to complete the rehabilitation project.

Even this major reconstruction did not bring an end to breakwater repairs at Kahului, for the north shores of all Hawaii's islands continue to be buffeted by seasonal waves as high as 30 feet. In December 1967 another section of the west barrier suffered damage from storm waves, and in September 1968 the District awarded a contract in the amount of $346,300 for repair of this section. Additional storm damages during construction in December 1968 re-

Tribars at Kahului Harbor, Maui, 1969.

quired change orders and raised the estimated construction cost to $383,500 as of 1 July 1969. The west breakwater repair work, still in progress on that date, included the casting and placing of approximately 260 19-ton tribars and their buttressing by concrete ribs.

Harbor basin dredging and breakwater repairs at Kahului thus occupied most of the District's energies in this era on Maui. With the completion of the most recent modification of the Kahului project, however, this harbor was enlarged to its maximum limits, for the basin is bordered by rough seas on one side and by a shopping center on the other. Thus in the early 1960's local interests and the Engineers sought new sites for possible Federal improvements on Maui. Preliminary consideration of Lahaina, Maalaea, and Kalepolepo resulted in the investigation of the feasibility of a harbor at Maalaea, the port first surveyed by Major Winslow in 1909. The authorization of a project for Maalaea would make Maui the fourth Hawaiian island with two Federal harbors planned for her shores.

The Big Island had received her second Federal port in 1959 with the construction of the project at Kawaihae. As discussed in Chapter VIII, the dredging contract was completed in July 1958 for approximately $2.3 million and the breakwater contract was completed in June 1959 for $646,422. In addition, a military ship landing was constructed under contract in 1959, while the Territory built a new pier and private firms erected a new sugar plant at Kawaihae Harbor. Among those attending the dedication ceremonies on 15 October 1959 were Governor Quinn, Colonel Clifton, and civilian employees of HED. Further improvements at Kawaihae took place in 1962, when contractors removed a large coral elbow to widen the entrance of the harbor basin at a cost of $468,963. The project was thus completed during July 1962.

Even before this final dredging operation was completed, a House Committee on Public Works resolution of 17 March 1960 directed the Honolulu District Engineer to review reports on Kawaihae Harbor with special attention to the advisability of constructing a second breakwater at the port. A public hearing in April 1962 revealed that even the proposed modifications would not satisfy the State's demands for an all-weather protected port at Kawaihae. Instead of approving this plan, then, in October 1965 Congress authorized the enlargement of the harbor basin and channel and the construction of a small boat harbor. The entrance channel would be widened to 500 feet at the outer end, tapering to the existing 520-foot width at the inner end; the basin would be enlarged to a maximum width of 200 feet and a length of 500 feet; and the existing breakwater would be extended by 750 feet. Estimated total project cost in July 1966 was approximately $2.5 million. In December 1966 the Waterways Experiment Station completed model testing, and in June 1968 OCE approved the design memorandum for the Kawaihae Harbor enlargement.

In the meantime, the separate study for a small boat harbor at Kawaihae was accelerated by a special project to demonstrate the practical applications of an engineering technique called "row charge excavation," using high explosives. The U.S. Army Engineer Nuclear Cratering Group in Livermore, California, provided the funds and technical direction which enabled the Honolulu District to accomplish a unique construction task. The work conducted in 1969 and 1970 provided an entrance channel and initial berthing basin of the small boat harbor by the detonation of 120 tons of ammonium nitrate explosive fired in three stages of 40 tons each. Calibration shots of one ton and ten tons of explosives were conducted in November 1969, and the results were used in designing the main charges from geometrical and seismic standpoints. This project, known as "Tugboat," added a new dimension to HED's endeavors in civil works by successfully demonstrating the use of explosives to construct various projects with savings in time and in equipment inventory which would be required by a contractor.

Calibration blast, Phase I, Project Tugboat at Kawaihae Harbor, Hawaii, November 1969.

Between 1957 and 1965, then, the major islands of Kauai, Oahu, Maui, and Hawaii all saw the construction of Federal harbor improvements. In addi-

tion, the smaller island of Molokai was the site of studies for possible Federal projects. At Kalaupapa Harbor on the island's north shore, the District planned to strengthen the existing 100-foot breakwater and to deepen the natural harbor basin from two feet to six feet. The proposed project for the barge landing received Congressional authorization on 2 December 1965 and construction was completed by contract in September 1967 at a contract cost of $134,543.

Also subject to improvements during this period was Molokai's Kaunakakai Harbor, where in the 1930's NIRA funds had allowed for Federal dredging to a depth of 23 feet. In autumn 1957 seven members of the House Committee on Public Works visited Kaunakakai and urged a study of the port; in January 1959 the District Engineer held a public hearing on the Molokai harbor. The 1962 report recommending Federal construction of a deepwater harbor declared such a project warranted on the basis of anticipated industrial growth, for local interests planned to establish a pineapple cannery on the island. As authorized by the River and Harbor Act of 22 October 1962, the project for Kaunakakai provides for a deepwater harbor comprising an entrance channel 500 feet wide and 40 feet deep; a harbor basin 35 feet deep over an area of 62 acres; a jetty 1,000 feet long; a west breakwater 3,000 feet long; a harbor basin for light-draft vessels 15 feet deep over an area of 10 acres; and a south breakwater 2,300 feet long to protect the basin for light-draft vessels and the entrance channel of the deepwater harbor. Estimated total first cost as of July 1964 was $9 million, of which $294,000 was to be a local cash contribution.

In 1965 the District completed a general design memorandum for the light-draft harbor at Kaunakakai and as of 1 July 1969 was awaiting the necessary State funds to initiate construction. Construction of the deep-draft harbor had been deferred as of the same date, pending indefinite plans by local interests for the proposed cannery which would justify the project. With the transformation of Kaunakakai Harbor into a deep-draft port, Molokai would become the fifth Hawaiian island to host a major Federal harbor.

The Honolulu District thus centered its civil works activities between 1957 and 1965 on dredging for new work, as at Honolulu and Kawaihae; on constructing or repairing breakwaters, as at Nawiliwili and Kahului; and on studying plans for new harbors, as at Barbers Point and Kaunakakai. In addition, the District handled a number of smaller tasks which included maintenance dredging and the salvaging of reef-bound boats. Highlighting 1962 was the arrival of the hopper dredge **Davison**, a twin-screw, diesel electric dredge with a maximum hopper capacity of 720 cubic yards. The **Davison** operated at a rate of 8,000 cubic yards per day to remove a total of 665,194 cubic yards from the harbors at Nawiliwili, Port Allen, Honolulu, Kaunakakai, Kahului, and Hilo between January and June 1962. Government plant did additional maintenance dredging at Nawiliwili, Port Allen, and Honolulu in 1968.

Among the salvage operations the District was called upon to perform in this period was the recovery of a drill rig which had been dropped into the sea about 400 feet offshore near Dillingham Air Force Base in late 1959. Although the high winds, rough seas, and strong currents characteristic of Oahu's north shore in winter made diving hazardous and the entire project extremely difficult, the Operations Division, in conjunction with the 65th Engineer Battalion, 25th Infantry Division, of Schofield Barracks, succeeded in salvaging the rig from its 12-foot depth. Two years later HED contracted for the disposal of a derelict concrete barge moored in Honolulu Harbor. The contractor removed 125,000 gallons of good oil, treated the remainder with detergents, towed the vessel to a disposal area 60 miles to the southwest, and sunk the barge there with explosives. "One of the biggest attractions in town" at the same time, according to the **Honolulu Star-Bulletin**, was the **Hiroshima Maru II**, a Japanese fishing vessel which had run aground on the reef off Oahu's south shore in January 1962. Fearing that the boat's 300 tons of frozen tuna might attract sharks if the hull should break, the Engineers requested Navy assistance in towing the vessel to Pier 39. A private firm then purchased the **Hiroshima Maru II** from the U.S. Army.[2]

A similar operation took place at Kahului, in May and June of 1962, after a private tug collided with a commercial freighter, sunk, and thereby blocked the harbor. A week of pulling and dragging raised the wreck to the surface; another two weeks' work by the Engineers refloated the tug. Six months later contractors removed and disposed of a derelict raft, a barge, and a sunken tug from Honolulu Harbor. Though perhaps not significant for the islands' future harbor development, these tasks nonetheless constituted an important part of the District's operations, for they helped to keep Hawaii's harbors free of navigational obstructions. The disposal of derelict vessels recalled HED's first job in 1905, the removal of the **Martha Davis** from Hilo Harbor, and illustrated again the diverse civil works duties performed by the Honolulu District.

In this period of HED's history, those diverse duties also come to include the consideration of several small boat harbors for the State. The River and Harbor Act of 17 May 1950 had authorized the preliminary examination of the coasts of the Hawaiian Islands with a view to establishing harbors for light-draft vessels. As with so many other civil works activities of the same era, however, the demands of the Korean War halted the small boat harbor studies soon after initial public hearings were held in 1951. The project lay inactive until 1958, when the River and Harbor Act of that year changed the investigation from a preliminary examination to

a survey. The District held new public hearings in January 1959 and resumed its study of the 45 sites suggested by local interests. The completed report would then serve as a master plan for the Statewide development of small boat harbors so that future Federally authorized projects could be geared to the State's own program.

The Engineers selected 19 of the 45 sites for eventual development as small boat harbors. State plans for 6 of these sites left 13 potential harbors to be investigated further by the Honolulu Engineer District. Of those 13, the 4 ports of Manele, Lanai; Maalaea, Maui; Haleiwa, Oahu; and Nawiliwili, Kauai were later studied under the authority of section 107 of Public Law 86-645, which covered small navigation projects not specifically authorized by Congress and not exceeding $500,000 per project in Federal costs. In June 1962, meanwhile, the District Engineer forwarded tentative plans for the other 9 harbors to the appropriate State agencies. After discussion over the location of the proposed harbor at Hanalei, Kauai, the District Engineer agreed with Governor Quinn that the east side of the bay, on the mouth of the Hanalei River, afforded the best site. At the same time the State accepted the Federal Government's reluctance to extend the breakwaters at Pokai Bay, or Waianae, Oahu, because of the unfavorable benefit-cost ratio which would result. By March 1963 all such points had been resolved and Colonel Williams submitted the first Interim Report on light-draft harbors for Hawaii.

Recommended in this report were small boat harbors for Hanalei, Kauai; Pokai Bay, Heeia-Kea, Kailua, and Maunalua Bay on Oahu; Lahaina and Hana, Maui; and Reeds Bay, Hawaii. The total estimated first costs for the 8 harbor projects, including non-Federal costs, were approximately $8.6 million. Estimated Federal construction costs exclusive of aids to navigation ranged from $243,000 for Kailua to $1,679,000 for Hana; benefit-cost ratios varied from 1.1 to 1 at Pokai Bay to 5.5 to 1 at Heeia-Kea. The District Engineer recommended that any of the harbors be constructed independently of the others whenever the required funds became available and the necessary assurances were provided by local interests.

A separate report published in December 1963 recommended the construction of the 9th small boat harbor, at Honokahau on the Kona coast of Hawaii. During the next few years the District Engineer considered projects at Punaluu and Waimanalo, Oahu, too, but found local residents opposed to the suggested improvements. Also investigated at this time were six harbors of refuge whose need the District Engineer recognized but whose tangible benefits at that time did not seem to justify their construction. These findings were incorporated in the third small boat harbor report, submitted on 30 June 1967. With this final report the District completed the $350,000 survey of the Coasts of the Hawaiian Islands which had begun in 1950. The 1967 report recommended

Small Boat Harbor at Manele, Lanai.

modifications of the 3 existing State light-draft vessel harbors at Kikiaola, Kauai; Ala Wai, Oahu; and Maalaea, Maui, as well as the construction of the 9 previously studied harbors, at a total estimated cost for all 12 harbors of $12,267,000.

By 1969 these small boat harbor projects had met with Congressional approval and several had seen actual construction. In 1963 and 1964 the Chief of Engineers authorized construction of the proposed harbors at Manele, Haleiwa, and Nawiliwili, under section 107 of Public Law 86-645. (The harbor for Maalaea, originally studied under this authority, had subsequently been recommended as a separate project in the 1967 report.) The same River and Harbor Act of 27 October 1965 which provided for an enlargement of Honolulu Harbor and a deep-draft port for Barbers Point also authorized the 9 small boat harbor projects recommended in the two interim reports of 1963. The River and Harbor Act of 1968 then authorized the modifications of the 3 State harbors at Kikiaola, Ala Wai, and Maalaea which the District Engineer had included in his final report on the survey of the Coasts of the Hawaiian Islands.

The first Federal-State small boat harbor to be constructed in the islands was the one built at Manele Bay, Lanai, to accommodate approximately 130 vessels. Authorized by the Chief of Engineers in May 1963, the project provided for a 490-foot extension of the existing State-constructed 100-foot long stub breakwater with a rubblemound breakwater with crest elevation of 14 feet at the head and 6 feet at the root; an entrance channel; a main access channel; and a maneuvering area. Plans and specifications were completed in January 1964, the construction contract was awarded that June, and the breakwater was finished in April 1965. The dredging of the shallow-draft harbor completed the project in December 1965. With the construction of this $666,555 small boat harbor at Manele, Lanai became the sixth Hawaiian island to host a Federal navigation project.

Meanwhile, the District began planning for Oahu's first Federal-State small boat harbor at Haleiwa on the island's north shore. The project authorized by the Chief of Engineers in March 1964 provided for an entrance channel 620 feet long, 120 feet wide, and 12 feet deep; a revetted mole 520 feet long; a trapezoidal riprapped river diversion channel 500 feet long and 80 feet wide; and a dike 320 feet long. Federal construction took place between late 1965 and November 1966; Federal costs of the $490,000 project were $295,000. The State has since begun the development of its portion of the Haleiwa light-draft vessel harbor, which should eventually accommodate 220 boats.

Honokahau, Hawaii, is the site of the third Federal-State small boat harbor constructed in the islands. Authorized by the River and Harbor Act of 1965, the project provided for the construction of an inshore harbor basin at this site on the Big Island's Kona coast. Model testing in Honolulu resulted in a design memorandum which was approved by OCE in March of 1968. Construction began that June and was highlighted in October 1968 by the direct offloading of explosives from the barge to the construction site. On 17 March 1970 Colonel Hughes formally turned over the completed small boat harbor to the State of Hawaii. Federal costs of the almost $2 million project were approximately $808,000.

Among the remaining light-draft vessel harbors authorized for construction in the Hawaiian Islands, only the projects for Nawiliwili, Maunalua, and Lahaina were funded as of 1 July 1969. In addition, a small boat harbor for Kawaihae was authorized in 1965 as part of the modification of the deep-draft harbor at that port and was being studied as Project Tugboat as of 1 January 1970. The construction of the small boat harbors at Manele, Haleiwa, and Honokahau and the study of more than a dozen other small boat harbor sites in the islands opened a new chapter in HED's civil works history. Although in the years since World War II the extent of the District's civil works activity may have declined in relation to HED's military construction projects, the civil works activity nevertheless increased in scope during those same years. The 1940's had seen the start of Federal flood control in Hawaii; the 1950's had witnessed the beginning of the District's efforts at beach erosion protection. Now in the 1960's HED added to its varied assortment of navigation tasks the investigation and construction of Federal-State small boat harbors.

Also of great interest as a navigation project in this decade was the Honolulu District's model testing of a breakwater to protect against tsunami damage at Hilo. The studies described in Chapter VIII and the public hearings held in October 1946, March 1950, August 1957, and January 1959 had led both local interests and the U.S. Engineers to favor the construction of a seawall to shelter Hilo's business district from future tidal waves. Further consideration of this plan was interrupted on 23 May 1960 by a new tsunami which destroyed 288 buildings, battered 291 others, and caused an estimated $22 million worth of damage at Hilo. Among the 61 persons who lost their lives in the 1960 tsunami was a 30-year old Honolulu District engineer. Sent to Hilo on the eve of the tsunami to gather data for the design of the District's proposed seawall, James K. K. Look was swept into the sea as the first waves broke upon the shore.

Two months after this disastrous tsunami, the River and Harbor Act of 14 July 1960 added to the survey authorization first given in 1946 the conditional authorization of the tidal wave project itself. Tsunami protection for Hilo was deemed so important and so urgent that "the project . . . (was) hereby authorized as determined to be justified by the Secretary of the Army with the approval of the President, unless within the first period of 60 calendar days of continuous session of the Congress after the date on which the report is submitted to it such report is disapproved by Congress."

Although this authorization referred specifically to the immediate study of a seawall, during the next few months the Engineers considered offshore protection as well. Most participants at the public hearing held on 7 October 1960 agreed that an extension of the east breakwater and the construction of a new west barrier would provide better protection, especially for the area hit by the most recent wave, than would a seawall along the shore. In his report of that November Colonel Ingwersen noted that the construction of the proposed offshore barriers would also extend the life of the present breakwater, reduce its annual maintenance costs, and partially resolve the surge problem in Hilo Harbor. The District Engineer cited an estimated construction cost of $21 million and an anticipated benefit-cost ratio of 1.1 to 1. Especially important was his insistence in the same report that, "since only limited data are available relative to tidal waves and surge conditions, model studies would be required to verify the design." The report went to Congress in June 1961 and the project to extend the existing breakwater to 10,570 feet and to construct a west barrier was authorized under the terms of the 1960 River and Harbor Act. In September 1961 the Chief of Engineers directed that hydraulic model investigations be made of the various alternative project plans, as an essential element of advanced engineering and final design.

Thus began preliminary plans for the Look Laboratory of Oceanographic Engineering, named after the young engineer who had lost his life on 23 May 1960. Although many members of the Corps of Engineers felt the hydraulic model should be built and operated at the Vicksburg Waterways Experiment Station, authorities in Hawaii urged its construction in Honolulu. In 1963, after a series of pre-model design conferences and preliminary pilot model tests at WES, the Chief of Engineers approved HED's recommendation that the model be constructed and operated in Honolulu. Concurrent

with the State's construction of the model building at nearby Kewalo Basin, during March, April, and May of 1964, the Engineers built the model in sections at Fort Armstrong. On 28 July 1964 Governor John A. Burns dedicated the building, the assembled model, the specially constructed pneumatic wave generator, and the appurtenant control and instrumentation apparatus as the Look Laboratory of Oceanographic Engineering.

Since the $115,000 Hilo Harbor Bay model was the first large-scale hydraulic model in the U.S. designed to generate and test tsunami waves, its construction and operation attracted considerable attention. Among the major purposes of the model study were the determination of the technical feasibility of the proposed tsunami control works for Hilo and the estimation of the relative degrees of protection afforded by the proposed barrier plans. In addition, the investigations would develop wave input data for use in two-dimensional tests at WES to insure the stability of the proposed barrier sections. WES provided the technical supervision of the testing program, while Mr. William J. Matthews, Chief of HED's Engineering Division, directed the actual model tests. Mr. Robert Q. Palmer, then Chief of the District's Hilo Harbor Model Branch, supervised his staff as they conducted the experiments at Kewalo Basin.

The reinforced concrete model of Hilo Bay consisted of 20 sections, each 12 feet square and weighing up to eight tons, mounted on adjustable leveling jacks. The overall width of the model measured 62 feet and the overall length 95 feet; 2,286 square feet of this area formed the contoured ocean area to 50 fathoms; and the model contained 31,000 gallons of water. As a result of pilot studies at WES, the model was constructed on a distorted scale of 1:200 vertical and 1:600 horizontal. Other pilot tests at WES had determined that the entire ocean area need not be included, provided that the wave generator was positioned near the mouth of the bay. Thus, instead of exciting an entire tsunami wave train in the small area of the model, the Engineers generated the long, bore type waves which had constituted the most destructive part of the tsunamis at Hilo Harbor. The design tsunami incorporated the 1946 and 1960 waves, increased in magnitude by 25 per cent.

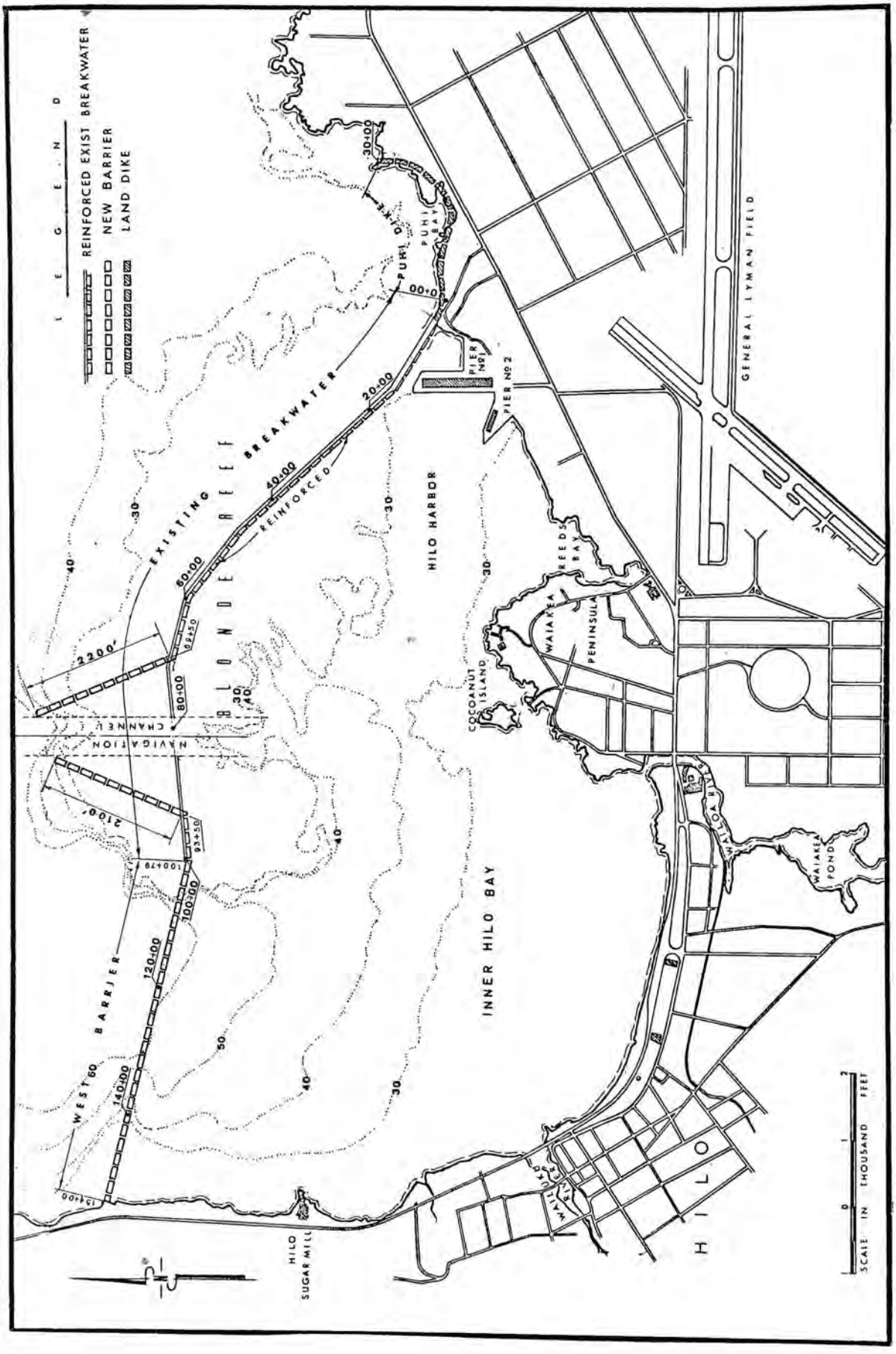
Hydraulic model testing at Look Laboratory began in July 1964. Six pneumatic long wave generators reproduced the bore type waves as a 30-channel electrically operated oscillograph and an electronic wave-height measuring system recorded wave data. The Engineers spent approximately ten months investigating prototype tsunami to determine a firm breakwater alignment and then, in May 1965, started testing to establish a preliminary breakwater crest elevation. Two basic offshore barrier schemes were considered: Plans A, A-3, M, M_n, and C_b all closed off the entire inner bay except for a navigation channel opening and all required the extension of the existing breakwater as well as construction of a new breakwater to the west. The other plans, D_3, D_{3T}, D_4, D_5, and D_6, closed off only the east half of the inner bay, by extending a new barrier from Waiakea Peninsula to the head of the existing breakwater, to protect against design tsunamis only for the eastern portion of Hilo. Extensive testing indicated that only Plan A-3, which closed the present one-mile opening in the harbor and incorporated a navigation entrance through Blonde Reef, would offer complete protection against tsunamis of the design magnitude.

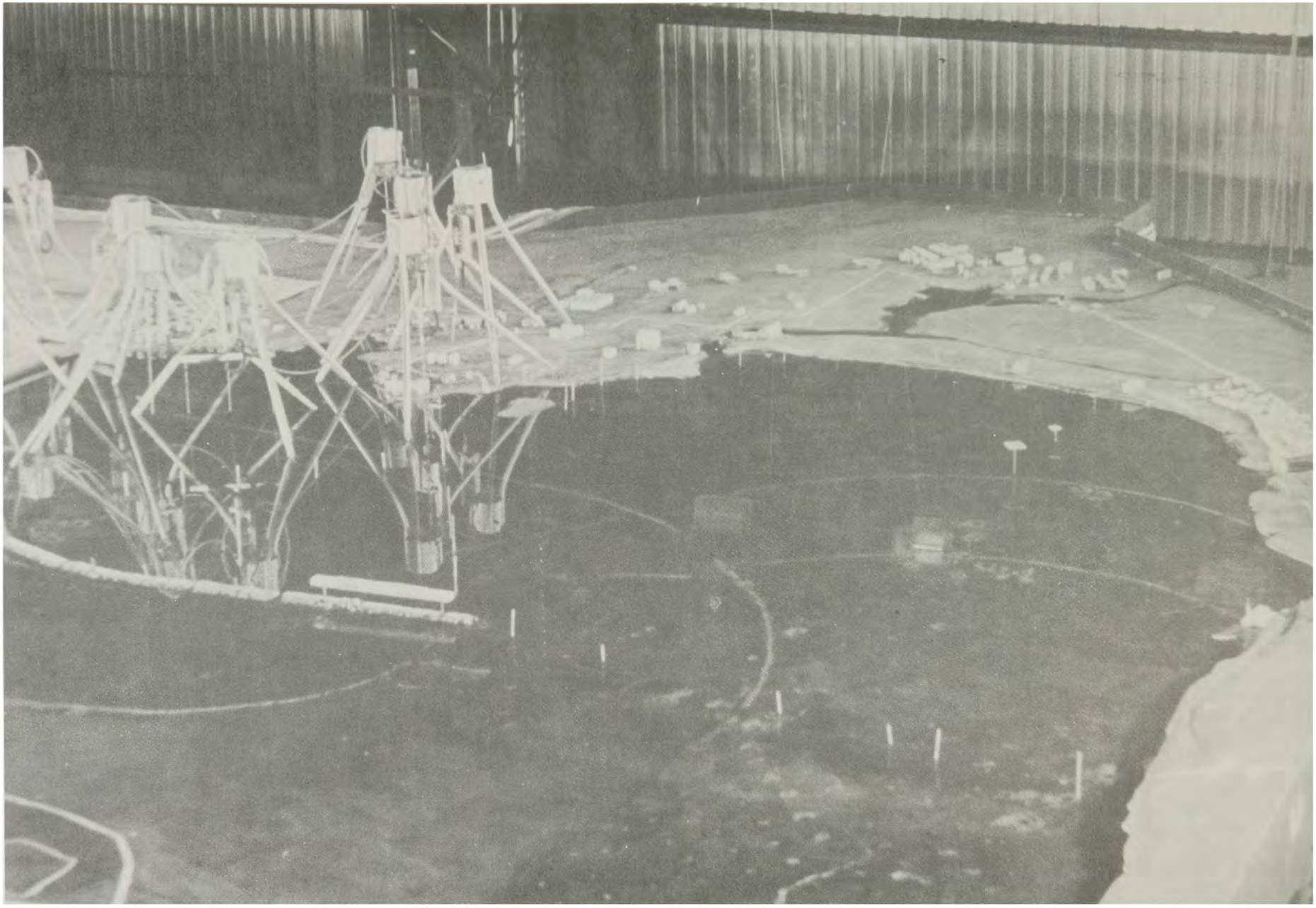
Concurrent with the model testing at Kewalo Basin were several other related projects, including development of a quarry site near Hilo, a topographic survey of the Hilo Bay shore area to an elevation of 40 feet, and a reconnaissance survey of the Hilo area. In addition to the testing done in Hawaii, at the request of the Honolulu District Engineer WES conducted barrier stability studies between July 1965 and April 1966. Using data from the Honolulu model, the WES staff subjected 1:50 scale models of rubble-mound barrier trunk sections to attacks to tsunamis and short-period waves and concluded that satisfactory overtopping section, necessary for stability against the design tsunami, would require an expensive concrete cap. WES published a report on steady-flow stability tests of navigation opening structures for the tsunami barrier plan in October 1966; the Honolulu District completed a qualified design memorandum on Hilo Harbor tsunami and navigation protection at Hilo on 31 July 1967; and in November 1967 the District published the final study of Proposed Barrier Plans for the Protection of the City of Hilo and Hilo Harbor, Hawaii.

As a result of the Look Laboratory tests and associated investigations, then, the Hilo Harbor project modification authorized in 1960 provided for strengthening and raising the existing breakwater to a total length of 10,570 feet and constructing a west breakwater 4,000 feet long as well as a 6,600-foot land dike. The prohibitive cost of the project has prevented actual construction of these improvements: the 1966 approved estimate of the total project first cost for new work was $43,930,000, of which $34,270,000 would be Federal cost and $9,460,000 a non-Federal cash contribution. Since the State of Hawaii has been unable to provide satisfactory assurances of such a large amount, the project has been indefinitely postponed.

In the meantime, the County of Hawaii has adopted other measures to reduce flood damage and to prevent loss of life in the event of future tsunamis. HED has assisted by providing information on the nature and extent of flooding so that the local government might establish zoning regulations to restrict development within the flood-prone area of Hilo. Also under consideration by the County of Hawaii is a building code prepared by HED; under such a code, new buildings to be located in wave-prone areas would be designed so that the structure would not be damaged by tsunami current or by rain

Plan A-3, proposed barrier plan for Hilo Harbor.





View of Hilo Harbor on model constructed at Look Laboratory of Oceanographic Engineering, 1964.

View of Hilo Harbor, looking southwest, showing existing breakwater, 1960's.

water flooding, while existing buildings would be strengthened against the force of a design wave. In addition, the local government has taken advantage of Federal urban renewal funds to redevelop a 385-acre area along the waterfront and near the city of Hilo. Project Kaiko'o consists of a 40-acre site which has been filled to an elevation of 20 feet and has been zoned for commercial use, as well as a park and recreational site to be developed by the State within the remaining 350 acres of the project.

The tsunami of 23 May 1960 has also led to efforts by the State's Civil Defense forces and the U.S. Coast and Geodetic Survey (USCGS) to improve and refine the Pacific Tsunami Warning System initiated in the late 1940's. Data contributed by the Tsunami Research Center at the University of Hawaii and by seismographs located in Hawaii and at other posts in the Pacific enable the USCGS to warn State officials of an impending wave hours before its impact is expected. The alert then issued by Civil Defense advises local residents to evacuate certain low-lying areas susceptible to attack by tsunamis. The improvement of the tidal wave alert system, the development of Project Kaiko'o, the establishment of zoning regulations, and the consideration of building codes are among the measures taken by Federal, State, and County agencies since the 1960 tsunami to protect the people and property of Hawaii against tidal waves.

Although these measures may have been adopted primarily as a result of the damages sustained in 1960 at Hilo, their implementation has lessened the possibility of loss of life on all of Hawaii's coasts and at other Pacific locations as well. In the same way, the experiments at the Look Laboratory of Oceanographic Engineering have had greater significance than for tsunami protection at Hilo Harbor alone. The model constructed by the Honolulu District is

the first of its kind and will undoubtedly serve as a prototype for other similar models. The tests conducted at Kewalo Basin between 1964 and 1966 have already produced data useful in other experiments, such as the barrier stability investigations carried out at WES during the same period. Furthermore, upon completion of the model studies for Hilo Harbor in March 1966, the Look Laboratory facilities were incorporated into the University of Hawaii's Kewalo Oceanographic Research Center in accordance with a 10 December 1963 memorandum of understanding with the State of Hawaii, which had not only built the laboratory which housed the model but also contributed over half of the construction cost of the model itself. As part of the University's research program, the laboratory facilities are still available by contract to HED and were utilized in 1967 to study the authorized deep-draft harbor at Barbers Point. Because of the model's widespread application beyond the boundaries of Hilo Harbor, the construction and operation of the facilities at Look Laboratory represented a significant achievement for the Honolulu District.

HED's navigation projects in this period thus included the actual construction of major harbor improvements, the study of over a dozen small boat harbor sites, and the investigation of tsunami wave characteristics at Look Laboratory. In addition to these harbor activities, flood control and beach erosion protection also occupied much of the District's time between 1957 and 1965. During these years, for instance, HED completed the construction of the three previously authorized flood control projects for Hanapepe, Kawainui, and Wailoa.

Congress had authorized the construction of flood control measures at Hanapepe as early as 1944, and the District had completed the general design memorandum in 1956. After the Federal Government received assurances of necessary local cooperation in March of 1959, then, HED awarded the contract for the construction of concrete walls and a levee along the river's left bank. In spite of an initial delay as some equipment sank in the soft river bed, in December 1959 the contractor completed the left bank improvements at a contract cost of $187,579. Over 20 HED employees attended the January 1960 dedication of the 2,200-foot long levee at Hanapepe.

Meanwhile, as work progressed on the river's left bank, engineering and design began on an additional levee for the right bank. Misunderstandings among

Completed flood control improvements at Hanapepe River, Kauai, looking south.

the State, the County, and the District over the status of real property on the right bank were finally resolved in October 1962, when the State agreed to grant temporary leases to the County, which in turn granted rights of entry to the Corps of Engineers. Between December 1962 and August 1963 the contractor constructed the 4,465-foot levee on the right bank for $179,678 to complete the existing project. On 15 April 1963, however, while construction was nearing completion, the Hanapepe River experienced a discharge of approximately 44,000 cubic feet per second, a rate exceeding the project design flow of 25,600 cubic feet per second by 75 per cent. The consequent reanalysis of the project design led to a modification to raise the heights of both levees by 3 feet. Authorized by the Chief of Engineers, this modification was completed by contract in November 1966. The final project cost approximately $588,000 and provided for a levee and flood wall about 2,200 feet long along the left bank and a levee about 4,465 feet long along the right bank. Delayed first by World War II and then by the Korean conflict, the flood control project for Hanapepe was finally completed in 1966, over 20 years after its initial authorization.

Similar delays occurred in planning for flood control protection at Kawainui Swamp. Congress had authorized the project in 1950 but had restricted funds during most of the following decade. Flooding in the spring of 1958 may have spurred the government to action, for the Territory's channel only partially halted this flow. A Congressional appropriation for fiscal year 1961 enabled the Engineers to continue with plans for the project. At this point, however, certain local interests proposed a real estate development for part of the swamp area, and the District was forced to hold further planning in abeyance pending a final decision by the local government as to the area's future utilization. After the City Council voted in September 1962 to acquire the land for a public park, HED proceeded with its original plans for the Federal flood control project.

A local contractor constructed the improvements at Kawainui Swamp between June 1964 and June 1966, when the project was formally dedicated and turned over to the City and County of Honolulu for operation and maintenance. The next two months saw the completion of demolition work and site cleanup by the contractor. Constructed at a total cost of $2,648,000, of which the Federal Government paid $1,380,000, the project for Kawainui Swamp widened and deepened the Oneawa Channel originally built by the Territory and protected the channel's side slopes with crushed stone. The contractor also excavated a silt basin 370 feet long at the entrance to the channel and built a groin and shore revetment at the channel mouth. Earth levees totaling 8,740 feet in length also formed part of the Federal project. With the construction of these improvements for Kawainui Swamp, HED completed another major flood control activity in Hawaii.

Also improved at the same time was Wailoa Stream near Hilo. Like the plans for Hanapepe and Kawainui, work for Wailoa had also been delayed by World War II and the Korean conflict, and the project had been authorized only in 1954. Among the improvements to be constructed at Wailoa were a channel 355 feet long and a levee 88 feet long to divert the Kawili Stream flow into Waiakea Stream, and a second channel 333 feet long and another levee 350 feet long to divert the combined flows of Waiakea and Kawili Streams into a long and narrow swale area. Diversion levees would then channel the flows from the swale area to a new excavated channel, 4,680 feet in length and bordered by earth levees totaling 6,510 feet.

Before construction of the authorized project began, the District performed a small snagging and clearing job on the Wailoa River in late 1958 and a similar project after the tsunami of May 1960. Estimated costs of the major flood control improvements meanwhile rose from $720,000 in 1960 to $1,170,000 in 1962, when the Chief of Engineers approved HED's general design memorandum. The contract awarded in October 1963 was modified to accommodate an unexpected field condition and was completed in August 1965 at a contract cost of $1,075,857.

In 1963 a study of a fourth Federal flood protection project for the Hawaiian Islands was authorized by the Chief of Engineers for Kuliouou Stream on Oahu. HED completed its study in 1966 and began construction of the project in September 1968. During the next year the contractor lined a major portion of the existing stream, added supplemental walls on the banks of the existing improved trapezoidal channel, and constructed a rectangular reinforced concrete lined ditch 7 feet wide to convey interior drainage downstream of Kalanianaole Highway. The $1.6 million project was completed in January 1970, six months ahead of schedule.

The District's major flood control activities in the 1960's thus focused on construction of the projects for Hanapepe River, Kawainui Swamp, Wailoa River, and Kuliouou Stream. In addition, HED carried out several smaller flood control tasks during this same period. Among the emergency repairs performed by the District were those needed at Wailupe and Niu Streams on Oahu after the storms of 5-6 March 1958 and additional restoration at Wailupe Stream in 1959. Contractors also repaired flood damages at the Kapalama Drainage Canal in 1964 and added emergency bank protection at Hakipuu Bridge, Oahu, in the same year. The early 1960's also saw the establishment of HED's Flood Plain Information Program.

Between 1957 and 1965 HED submitted a series of unfavorable recommendations on flood control projects for other Hawaiian rivers and streams. Although the District did not recommend construction of these projects at this time, their consideration and study did indicate increased interests and activity in

Federal flood protection for Hawaii. Among the unfavorable recommendations was that for Ainako Stream, Hawaii, whose study was completed in May 1959. In November and December of that year the District conducted engineering studies on snagging and clearing the Hanalei, Hanapepe, Waimea, and Wailua Rivers on Kauai and concluded that this work was not then justified. Similar reports were completed on small projects not specifically authorized by Congress for Kaelepulu Stream, Oahu, in 1960 and for Kahoma Stream, Maui, in 1961. Also under the category of flood control, in January 1965 HED submitted a negative report on the feasibility of providing lava barrier protection on the island of Hawaii. In the late 1930's the South Pacific Division Engineer had deemed the construction of lava barriers on Mauna Kea not economically justified. In 1965 the Honolulu District Engineer likewise concluded that a permanent defense against lava flows would not halt eruptions originating below the barriers and that even flows from higher regions could build up behind and overflow the proposed dikes. In the area of "flood" control as well as in the field of tsunami protection, Hawaii's environment introduced unusual activities to the Honolulu District.

The islands' geography also kindled Federal participation in beach erosion protection on Oahu and Kauai. At Waikiki, the U.S. Engineers had contributed one-third of the first cost of the improvements completed by the Territory in 1957 and in 1960 began a new study of possible further protection for this rapidly eroding beach. Hydrographic and topographic surveys, sand soundings, and wave analyses resulted in the Cooperative Beach Erosion Control Study report of August 1963; at this time the District Engineer recommended the artificial placement of 10,800 linear feet of new beach, the construction of new groins and the removal or modification of existing structures, and the extension of the existing stormdrains. Authorized in lieu of the previous project, by the River and Harbor Act of 1965, this plan for the improvement of Waikiki Beach would provide an

Aerial view of Fort DeRussy segment of Waikiki Beach, looking east, April 1970.

additional two miles of beach area from the Duke Kahanamoku Beach on the west to the Elks Club on the east. The District Engineer's report divided the beach area into eight segments corresponding to sites along the Waikiki waterfront and listed in order of priority: Kuhio Beach, Reef-Halekulani, Royal Hawaiian-Surfrider, Fort DeRussy, Kapiolani, the Natatorium, Elks Club, and Crescent Beach. Estimated first cost of the project as of 1 July 1969 was $4,660,000, of which $3,050,000 would be the Federal share; the anticipated benefit-cost ratio was 14.6 to 1.

While awaiting Federal appropriations, the State began the design of the Kuhio Beach segment and in late 1968 loaned the U.S. Engineers $56,000 to begin preconstruction planning on the project. The Chief of Engineers meanwhile approved the construction of the Fort DeRussy portion with non-appropriated funds, and sand placement in this section began in the fall of 1969. Economically justified as an improved tourist facility, the widened beach at Waikiki will serve Armed Forces personnel and Hawaii's permanent residents as well.

The two beach erosion projects authorized for Kauai did not fare as well in the 1960's as did the plans for Waikiki. The River and Harbor Act of 1958 had provided for Federal participation in one-half the costs of a 1,240-foot long rubblemound seawall at Waimea; ten years later, the project still awaited initial construction. The same act authorized a similar seawall for Hanapepe Beach, where Hurricane Nina had washed out shoreline roads in 1957. HED completed plans and specifications for this project in June 1964; the State advertised for bids that summer; but even the lowest bid received exceeded the total State and Federal funds available. The State has therefore deferred indefinitely construction of the beach erosion project for Hanapepe.

This period did see the study, authorization, and complete construction of a beach erosion project at Haleiwa Beach on Oahu. At the request of local interests, in 1960 and 1961 the Honolulu District and the State of Hawaii conducted a cooperative study of beach erosion for Haleiwa Beach. A public hearing held in August 1961 and the advice of a consultant from the Beach Erosion Board the next January contributed to the District Engineer's favorable report of November 1962. Authorized by the River and Harbor Act of 27 October 1965, the project for Haleiwa provided for a beach fill 1,600 feet in length, 140 feet to 265 feet in width, and 202,000 square feet in area; an offshore breakwater 160 feet in length; and one groin 520 feet long. In 1965 the State constructed the entire beach erosion project at a cost of $400,246, 60 per cent of which was then reimbursed by the Federal Government. The restoration of the beach at this popular resort area provided expanded recreation space on Oahu's growing north shore.

Beach erosion protection constituted only part of HED's varied civil works program in this period of increased activity. On all of Hawaii's major islands, the District engaged in new and unusual tasks: on Kauai and Maui the Engineers reconstructed breakwaters with precast tribars; on Oahu HED built the State's first bascule bridge; and on Hawaii the District conducted explosive excavations as part of Project Tugboat. The small boat harbor master plan drawn up for the State of Hawaii also occupied the Engineers between 1957 and 1965, while model testing of tsunami waves at Look Laboratory attracted nationwide attention to HED. Matching these navigation activities in the field of flood control was the completion of four major flood control projects in the islands and, in the area of beach erosion protection, further planning for the shores of Oahu and Kauai. Variety as well as volume characterized the renewed postwar civil works program of HED.

Footnotes — Chapter IX

1. The **Honolulu Advertiser**, 27 June 1959, p. B4, col. 6.
2. **Ibid.**, 13 March 1962, p. 1, col. 4; The Honolulu **Star-Bulletin**, 6 April 1962, p. 9, col. 1.

CHAPTER X: Rebirth, Continued: From Capehart to Nike-X

In military construction as well as in civil works, the Honolulu Engineer District experienced tremendous growth between 1957 and 1965. The return of large numbers of troops after the Korean War, the release of funds for housing and related community facilities, and the resumption of the normal pace of construction resulted in increased military activity in the islands after 1957. Also shaping HED's construction program at this time were the nation's changing defense requirements. In response to the threat of attack by enemy planes HED built a ring of anti-aircraft sites on Oahu, while in response to potential land-launched weapons the District constructed anti-missile facilities at Kwajalein. The reestablishment of the Honolulu Engineer District produced an expanded military program in both Hawaii and the Marshall Islands.

Much of the District's work in Hawaii in these years revolved around housing projects for the U.S. Army. Among the Federally financed projects for Schofield Barracks, for instance, were 80 family quarters constructed between June 1957 and March 1959 for just over $2 million. HED also spent $467,000 on a new commissary at Schofield Barracks and saw this building completed in May 1959. A year later contractors constructed a 60-man bachelor officers' quarters building at Schofield for $424,284. Two hundred and fifty more family housing units were completed at Schofield in October 1964 for slightly more than $4 million, while a $2 million project of an additional 100 family quarters was finished in March 1966. Fort Shafter as well as Schofield Barracks received new housing facilities in 1959, as HED supervised the construction of a $154,000 barracks building for fifty enlisted women.

In addition to these Army housing units at Schofield and Fort Shafter, the District also supervised the construction of several housing projects financed under Capehart legislation. At Schofield Barracks, Fort Shafter, and Tripler Hospital the Engineers provided hundreds of units of family quarters between 1957 and 1965 as the Capehart housing program ushered in a new era in military construction for HED. First and largest of this period's Capehart housing projects was the 1,326-unit complex planned for Schofield Barracks. After a delay when the original low bidder withdrew his bid, in July 1957 the District signed 12 separate contracts with the joint venture of Robert E. McKee, General Contractor, Inc.; Nordic Construction, Ltd.; and Theo G. Mayer and Sons for construction of the 1,326 units at a cost of $21.6 million. Related contracts included two with Theo G. Mayer for the construction of supporting utilities and roads and for the removal of buildings and structures at the project site.

Groundbreaking in August 1957 was accompanied by the establishment of a Capehart Project Office, which by January 1958 had become the largest field office in the District. By April 1958, when the Project Office was renamed the Capehart Residency, its staff had received 1,075 letters from the contractor and had written over another thousand. "The hardy pioneers of Capehart" apparently delighted in the martyrdom imposed by strikes, flash storms, dust, and lack of utilities, and took pride in showing off the growing facilities to the many government and military representatives who visited Schofield in 1958.

June of that year brought a grand-opening ceremony of the first 43 completed units, while on 31 July a gala ribbon cutting and a three-day open house marked the transfer of the first noncommissioned officers' quarters. The final contract closing took place in early 1959. This Capehart project provided 980 quarters for enlisted men, 260 for junior officers, and 86 for officers of field grade. The completion of the 1,326 units greatly relieved housing pressures in the Wahiawa area of Oahu and successfully launched the District on its Capehart career.

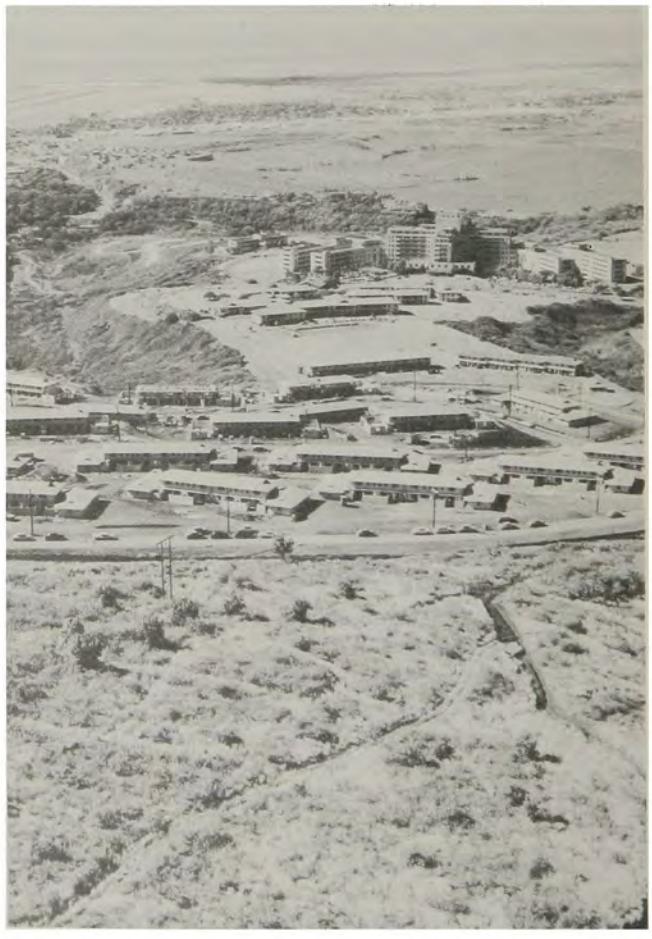
As soon as the construction of the 1,326-unit project at Schofield had gotten underway, HED advertised for bids for similar but smaller housing complexes at Fort Shafter and Tripler. In March 1958 M. J. Brock and Sons, Inc., and Associates of Los Angeles signed two contracts for each of the two sites in the total amount of $4,123,035, while a local contractor received the award for the construction of supporting utilities. The 100 units at Tripler and the 150 quarters at Fort Shafter were completed in early 1959 and the final contract closing was held that May.

By mid-1959, then, HED had supervised the construction of over 1,500 units of Capehart housing. Bringing that figure to over 2,400 in 1962 was the completion of the District's third Capehart housing project, at Schofield Barracks and Fort Shafter. Once again delays in bidding for the construction

Capehart housing units at Fort Shafter, January 1959.

Capehart housing unit at Tripler, January 1959.

Aerial view of Capehart Housing project constructed at Fort Shafter, January 1959.



Aerial view of Capehart housing project constructed at Tripler, January 1959. The hospital is in the upper right of the photo.

contract postponed groundbreaking, as rising wage rates and tight money forced the original low bidder to default in 1959. Re-advertisement resulted in the May 1960 award of six contracts to Hawaiian Dredging and Construction Co., Ltd., of Honolulu. The 480 units at Fort Shafter and the 384 quarters at Schofield were to be completed in October 1961 at a cost of approximately $13,295,141; supporting utilities and site preparation were covered under a separate contract with Hawaiian Dredging and Construction in the amount of $1,004,200. During construction the District became involved in litigation concerning a change in the type of paint used in the 864 units. The resulting delays postponed the completion of construction approximately 100 days, so that the final contract closing took place between September 1961 and February 1962. Total cost of the project, including related facilities, was $15,541,751. Additional housing projects at Schofield included a complex of 250 units completed in October 1964 and another set of 100 units finished in March 1966. Construction costs of these 350 quarters totaled approximately $6.5 million.

The completion of so many new housing units at Schofield, Fort Shafter, and Tripler called for the construction of other facilities at these three posts. In 1960 and 1961, for instance, the District supervised the building of a $600,000 chapel at Schofield Barracks. Formally dedicated in February 1961, the religious center included a main sanctuary seating 600, 18 classrooms, four chaplain's offices, and an educational wing. A $340,000 tank maintenance facility was completed at Schofield in November 1962, while a group of tactical equipment shops at the post cost $1,847,251 to build in 1965 and 1966. Local contractors also completed a brigade headquarters building at Schofield in January 1967 for $586,258.

Among the improvements constructed at Fort Shafter at this time was a $123,000 fire station, completed in April 1961. Tripler Hospital meanwhile received two electric passenger elevators in 1961, while in 1966 the District arranged for alterations to the surgery and delivery suites at the hospital. Since no more than two surgery rooms could be removed from service at one time, these modifications required careful scheduling by the contractor. The installation of the elevators cost approximately $65,000 and the alteration of the suites just over $91,000. The construction of these various facilities at Schofield, Fort Shafter, and Tripler accompanied the extensive housing programs carried out at those three Hawaiian posts in the early 1960's.

During these years the District handled many projects for the Air Force as well as for the Army. Construction at Hickam Air Force Base took place in three general phases, the first of which occurred in 1958 and 1959. The resident office established at Hickam in the summer of 1958 supervised the construction of a $314,318 base chapel and educational wing which were completed in late summer 1959. Also in 1959, local contractors built officers' quarters at the Air Force base, for $676,253. Among the more technical tasks performed at Hickam at this time were the installation of antenna and microwave facilities in 1958, for $321,890, and the construction of an addition to the existing Globecom relay center in 1960, at a cost of $21,569.

As construction of these facilities neared completion, the District began work at Hickam on a hangar, apron, and taxiway for the Hawaii Air National Guard. Design was completed by contract between June 1959 and October 1960; the Hickam Project Office was reactivated in the fall of 1960; and construction contracts were awarded during that year. A joint venture of Robert E. McKee and Nordic Construction was to build the Air National Guard hangar and apron for $1,847,336, while James W. Glover would construct the access taxiway for around $400,000. Slow in its initial stages, the pace of construction of the Air National Guard facilities accelerated after January 1961. That October the apron was completed and in December the access

Housing project constructed at Schofield Barracks in 1965 and 1966.

Typical noncommissioned officer housing unit, Schofield Barracks, 1966.

taxiway was finished, while by January 1962 the hangar was being utilized by the Guard. A third contract awarded in January 1961 to Morrison-Knudson resulted in the construction of an extension to the Guard's instrument runway by November 1961. Dedication ceremonies in February 1962 marked the transfer of these improvements, constructed at a total cost of almost $2.5 million, to the Hawaii Air National Guard. The District then paid Pacific Construction Company of Honolulu $290,358 to construct missile storage and checkout facilities for the Guard during 1962, and contracted with C. W. Vincent of Honolulu to construct an additional taxiway for $780,109 that same year. The construction of these improvements for the Air National Guard in 1960, 1961, and 1962 constituted an important part of HED's program at Hickam.

Few projects were completed at the Air Force base in the next few years, as military construction followed the trend noted earlier and declined slightly around 1962. Not until June of 1964 did the District establish a new project office at Hickam. Local contractors built a fire station at the air base between March 1964 and January 1965, then, for $156,715, while others constructed an air freight terminal for $435,484. Additional facilities for the Air National Guard included an ammunition storage security guard house completed for $55,500 in February 1965. That year also saw the construction of electrical power plants and a settling tank for jet fuel as part of a project worth just over $400,000.

In this third phase of construction at Hickam were erected a total of 250 family housing quarters. The first 150 units were finished in November 1965 at a cost of approximately $2.4 million; the second group of 100 quarters was completed in May 1967 for $2.2 million. The District also supervised the construction of a $536,974 array of enlisted dormitories in 1965 and 1966, while another airmen's dorm was constructed for $915,032 between July 1967 and January 1969. In 1958 and 1959, again in the early 1960's, and once more after 1964, the Honolulu Engineer District handled a wide variety of construction projects at Hickam Air Force Base.

Family housing constructed at Hickam Air Force Base, 1966.

Other Air Force projects in this period focused on Test Tracking Station facilities at Oahu's remote Kaena Point. A Project Engineer made daily forays to this outpost to supervise the extensive construction program there. One of the first contracts awarded during the early phase of Kaena Point construction was that signed on 20 March 1958 with James W. Glover, Ltd. The original contract called for the construction of an access trail; within a few months two more trails had been added and the contract amount almost doubled. An unusual Kaena Point project involved the construction of a game bird watering device, an item added to this same contract in July 1958 at the request of the Territory of Hawaii. The new rainfall catchment dug to the right of Trail C replaced a self-filling watering unit threatened by construction at the site and thus provided a continuing source of water for the area's wild game. Even on the secluded northwest point of Oahu, the U.S. Engineers displayed a wide range of talents.

The initial contract with Glover was completed in October 1958 for a total amount of $376,517. A second contract with the same firm signed in May 1958 and completed that November covered the construction of part of the administration building and two antenna support structures. The final amount of this contract was $259,088. Under additional contracts with other local firms, water supply and sewage disposal systems and electrical distribution lines were constructed in 1958.

Rapid progress on the Kaena Point project enabled the District to hold an inspection on 18 August 1958 of those interim facilities constructed thus far at the Test Tracking Station. Work then continued on the second phase of the project, as HED signed new contracts during the next few years for the construction of supplementary facilities, temporary modifications, and additions to existing structures. Between November 1963 and March 1965, for instance, local contractors installed new air-conditioning and lighting systems and an accoustical ceiling on Building 10 at Kaena Point, raised the roof of the existing room, and built a penthouse on the roof for an air handling unit, at a total cost of $147,579. A $57,000 contract with another firm ran from June to November of 1964 and resulted in the construction of a radome support structure at the site. More recent construction included a standby electric power plant, completed in March 1967 for $483,529, and satellite antenna support facilities, built in May 1968 at a cost of $295,491.

Test Tracking Station facilities at Kaena Point and Air National Guard improvements at Hickam thus were among the Air Force construction projects managed by the Honolulu District in this period of increased activity. At both sites work slowed down around 1962 and then picked up in 1964, and at both sites HED called upon a familiar assortment of

Radome support structure, Kaena Point, Oahu, 1964.

local contractors to carry out the various improvements. Air Force as well as Army construction made up an important part of the District's expanded workload after 1957.

Local firms also handled many of the smaller military construction projects built between 1957 and 1965 on most of Hawaii's major islands. On Oahu, the District paid $13,940 in 1962 for modification of the pumping and sprinkler systems at Punchbowl and $66,346 in 1965 for an addition to the relay power facilities at the Aliamanu communications station. Another contract completed in June 1966 for $177,126 altered the electrical distribution system at the Aliamanu military reservation. At Helemano Radio Receiving Station, also on Oahu, the District supervised the construction of a $38,000 satellite communication facility and a $200,000 defense communication system during 1964, 1965, and 1966. A mainland firm completed lighting installations at Wheeler Air Force Base in July 1966 for approximately $340,126.

Other military projects on Oahu included the Reserve Training Center completed at Fort DeRussy in early 1960. The project office established at this Army post in early 1958 supervised the $600,000 contract covering the construction of both the training center and a maintenance shop. A decade later, HED found itself again involved with military construction at Fort DeRussy, as a 1966 Department of Defense decision to retain the post led to a redevelopment program of the DeRussy recreational center. In early 1969 the District awarded the design contract for the new Fort DeRussy Armed Forces Recreation Center facilities, which include a 416-room high rise hotel, several clubs, a post exchange, a theater, bathhouses, and a snack bar. The spring 1970 estimated costs of the project, financed entirely by nonappropriated funds, were over $18 million.

These plans for the Fort DeRussy recreation center climaxed over half a century of construction at the post and called further attention to the changing defense posture of Oahu. In building gun batteries at Fort DeRussy in 1910, the District had provided direct protection from invasion by sea, and the post had taken its place in the "chain of sentinels" guarding Honolulu Harbor. Two world wars and a conflict in Korea then encouraged America to maintain a reserve of armed forces even in peacetime; Fort DeRussy thus became the island's major recruiting and reserve training facility; and the Honolulu District responded to this development by constructing the Reserve Training Center between 1958 and 1960. With the 1960's came American participation in guerrilla warfare overseas, an expanding program of rest and recreation for the nation's war-weary soldiers, and the emergence of Hawaii as a major R and R center in the Pacific. HED once again followed the changing situation as it began planning for the new recreation center at Fort DeRussy. When the fort's old gun batteries were recently demolished for the new recreation center complex, the U.S. Engineers' work mirrored dramatically the history of national defense on Oahu over the past sixty years.

Maui, Hawaii, and Kauai as well as Oahu saw some military construction between 1957 and 1965. On Maui, the Army awarded its Patriotic Civilian Service Award to Arisumi Brothers, Inc., for their construction of the $200,000 Army Reserve Training Center at Wailuku from 1960 to 1962. HED also supervised the construction of an optical tracking facility on Haleakala, Maui, in 1964 and 1965 at a cost of approximately $716,000, and spent $125,586 in 1962 to construct Air Force Technical Applications Center facilities at Hilo, Hawaii. Construction on Kauai centered around a 35-man barracks building, a mess, and utilities for the Pacific Scatter System at Kekaha. A Project Engineer from HED supervised the construction of these facilities, which cost $212,375 and were completed in 1962.

Other work performed by the Honolulu District on the outer islands involved a program of cooperative fallout shelter studies. In late 1961 HED and the Public Works Office of the 14th Naval District coordinated plans for a survey which would investigate those existing structures in the islands suitable for use as public fallout shelters. The Navy handled shelter sites on Oahu; the U.S. Engineers supervised the survey on the other islands through contracts with various architect-engineer firms; the State and County governments furnished supplies necessary to the project. In Phase 1, completed in March 1962, the contractors located those structures which might provide protection; in Phase II, finished later that year, the architect-engineers prepared sketches and cost estimates for converting the potential sites

into public shelters. The preparation of these reports in 1962 reflected that year's fear of enemy attack and radiation. Once more the Honolulu District's activities depended on patterns of national defense.

This dependence manifested itself even more clearly in HED's important role in the Nike construction programs of the 1960's. The Nike-Hercules anti-aircraft missile complex on Oahu consisted of 6 sites at 4 different locations on which 72 missile launchers would be placed. One of the District's first tasks in connection with this project involved the preparation of a lengthy planning report by the Real Estate Division. In January 1957 that office submitted information concerning the locations, types, ownerships, and values of the real property interests required for the Nike-Hercules batteries on Oahu. The sites were selected on the basis of tactical spacing of the batteries and with a view toward utilizing government land to the greatest possible extent. Enough land was included in each control area for tactical facilities, administrative offices, and clearance easements. Among the interesting recommendations of the real estate planning report was the proposed exchange of military reservation land for Campbell Estate property more suitable for construction of the launcher and control sites.

The planning report investigated four sites which were to have one battery on each and two sites which would hold dual batteries. Later in 1959 the District awarded separate contracts for the design of these eight batteries, whose OCE standard drawings had to be adapted to suit special conditions in Hawaii. During the design phase, then, two single sites were deleted, so that the actual Nike-Hercules program neared the start of construction with single batteries approved for the Kahuku and Mokuleia areas and dual batteries planned for the Waimanalo and Ewa regions of Oahu.

During the first half of 1960 HED awarded contracts to four firms for the construction of the Nike-Hercules batteries. The familiar joint venture of Robert E. McKee, General Contractor, Inc., and Nordic Construction, Ltd., won the contract to build the dual battery at Sites 6 and 7, at Ewa, beginning in February 1960, and completed their construction in March of 1962. Also awarded in February 1960 was the contract with Price-McNemar Construction Co. of Van Nuys, California, to construct the single battery at Site 8, Mokuleia. This work was accepted in May 1962. James W. Glover, Ltd., meanwhile, built the dual launcher at Waimanalo Sites 3 and 4, between April 1960 and September 1961, while Morrison-Knudson Company, Inc., constructed the single battery at Site 1, at Kahuku, between June 1960 and March of 1962. These last two contracts both specified three stages of construction: launcher pads, buildings and utilities, and grassing. Included in the first of these phases at Site 1, for instance, were frequency converter pads, access roads, utility lines, acquisition and tracking radar pads, and boresight mast foundations and anchors. A fifth concurrent contract with Morrison-Knudson ran from June 1960 to April 1962 and covered construction of control area facilities for the dual battery at the two Waimanalo sites. These five contracts alone totaled $8,377,684 when completed.

Realizing the significance of the Nike-Hercules batteries, not just in terms of the program's cost but also as a vital link in the national network of defense, District employees followed construction progress with interest. Earthmoving equipment especially fascinated HED: Morrison-Knudson brought to the site a large TC-12 bulldozer with a 21-foot blade and twin engines of 450 horsepower, while the contractor's rubber-tired, hydraulically operated scraper earthmover also attracted attention. As construction of the Nike-Hercules batteries neared completion in January 1961, HED began to turn over the finished launcher facilities to the Hawaii Army National Guard. The Guard then made each site tactically operational with temporary control facilities while awaiting final completion of entire sites. Partial joint occupancy of some sites by the contractor and the using agency also hastened the utilization of the project before all facilities had been installed. On 4 March 1961, then, the dedication and formal transfer of Sites 3 and 4 at Waimanalo symbolized the eventual completion of the entire $10 million project.

As with many of HED's harbor projects, the last Nike-Hercules batteries had no sooner been accepted and transferred than the District contracted for modifications to the original program. James W. Glover constructed improvements at Sites 1, 3, 6, and 8 between June 1962 and August 1963 for $646,813, while the UNITEC Corporation of Maryland built new radar facilities at the same sites in 1965 and 1966 at a cost of $71,131. Even these modifications, of course, could not prevent the eventual replacement of the Nike-Hercules system with other modes of defense, as new developments in the 1960's emphasized protection against missiles in addition to defense against enemy planes. In early 1970 the Army announced plans to dispose of the six Nike-Hercules sites on Oahu. In spite of this conclusion to the Nike-Hercules chapter, however, the construction of the batteries formed an important part of HED's recent history. The project further solidified good working relationships with a variety of local contractors, first of all, who have continued to compete for other HED construction jobs. The Nike-Hercules program also served as an excellent example of HED's flexibility in reacting to changing world situations, for the threat of attack by enemy planes and America's developing missile capability inspired the construction of the batteries to defend Oahu. Furthermore, Nike-Hercules represented only one phase of HED's work with America's missile system. While the District supervised the construction of this defense member of the Nike family in Hawaii, HED also managed the construction of important aspects of

advanced Nike research and development in the Marshall Islands. By the mid-1960's Nike-Hercules, Nike-Zeus, and Nike-X had become familiar household words at HED.

The Department of Defense's decision in 1959 to use the Kwajalein atoll as a major testing site for Zeus missiles greatly affected the history of the Honolulu District. Earlier that year the Navy had designated Kwajalein as surplus to its needs; instead of abandoning the site, however, now the government incorporated the islands in the Pacific Missile Range, and the U.S. Army Rocket and Guided Missile Agency (ARGMA) at Huntsville, Alabama, took charge of the Nike-Zeus research and development program at Kwajalein.

A solution against attack by supersonic intermediate range ballistic missiles (IRBM's) and intercontinental ballistic missiles (ICBM's), Nike-Zeus was the third generation of the missile family which began with Nike-Ajax and Nike-Hercules. The test plans which developed in 1959 called for the firing of ICBM's from Vandenburg Air Force Base in California or IRBM's from Johnston Island in the Pacific and the interception of these offensive weapons by Zeus missiles launched from Kwajalein Island. Soon after the radars of the Zeus battery detected and began to track the Atlas, a computer would fire automatically a Zeus missile, while radar sets tracking both weapons would feed position data into a computer. The computer would then guide Zeus by radio command into the path of the oncoming missile. Nike-Zeus testing would also try to detect an actual warhead from among a barrage of decoys. Primarily of a system tests nature, the experiments at Kwajalein would check the system in its entirety and evaluate overall system performance throughout the entire zone of effectiveness. The Secretary of Defense noted in 1960 that whether or not the Zeus weapon ever went into production, the Nike-Zeus testing program would provide valuable knowledge in the whole field of anti-missile work.

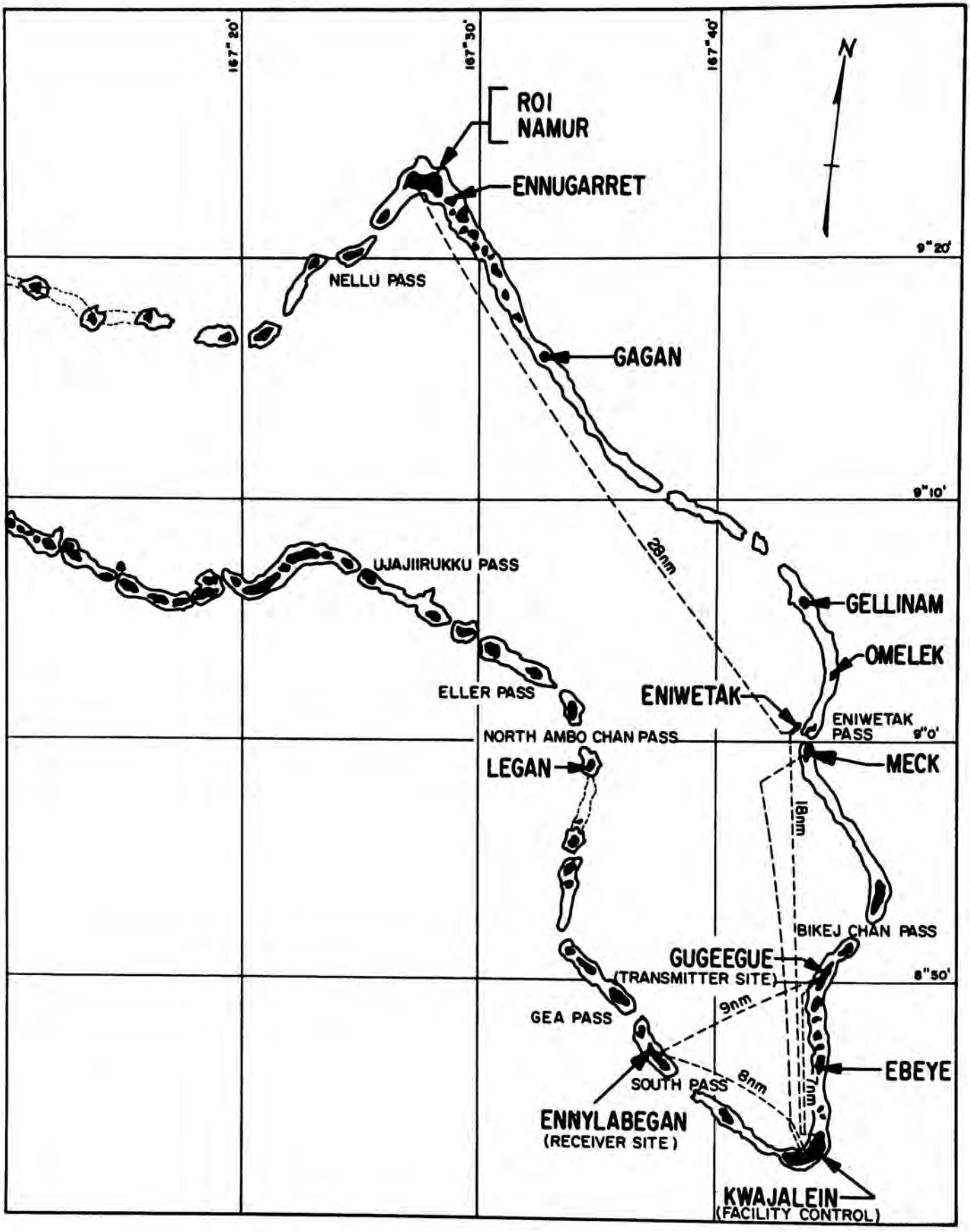
During the next decade the names of both the defense testing program at Kwajalein and the sponsoring agency changed several times. On 30 January 1964, Nike-Zeus was officially succeeded by Nike-X, and Sprint and Spartan missiles began to replace the smaller Zeus. A later portion of this chapter will discuss the modifications made to many Zeus facilities for use with the Nike-X. Nike-X was then redesignated the Sentinel System on 15 November 1967, while the program is now known as Safeguard. These program modifications were accompanied by changes in the name of the using agency. Begun under the sponsorship of the U.S. Army Rocket and Guided Missile Agency, the program shifted to the U.S. Army Materiel Command on 13 February 1963. 1 July 1964 saw Kwajalein itself transferred from Navy to Army command as the Kwajalein Test Site, a Class II installation assigned to the Nike-X Project Office at Redstone Arsenal, Alabama. Concurrent with the program's redesignation as Sentinel, on 15 November 1967, came the transfer of the resources and staff of the Nike-X Project Office, including KTS, to the new Sentinel System Command, and on 15 April 1968 KTS became the Kwajalein Missile Range. The testing program is now sponsored by the U.S. Army Safeguard System Command.

Closely related to Nike-Zeus and its successor programs has been Project PRESS, a ballistic missile defense research project sponsored by the Advanced Research Projects Agency (ARPA). The island of Roi-Namur in the Kwajalein atoll has served as the center of this program to study missile re-entry characteristics and electromagnetic signatures. Construction of Project PRESS facilities on Roi-Namur ran concurrently with construction of Nike-Zeus and Nike-X facilities on Kwajalein Island.

HED's role in these important research and development programs involved the construction of the "brick and mortar" portions of Nike-Zeus technical facilities as well as community and support facilities for the projects. To the Pacific Ocean Division, and hence to the Honolulu Engineer District, was assigned the responsibility for building those structures necessary for housing both control and launching facilities for Nike-Zeus on Kwajalein. With this responsibility began a new era for HED.

At home at Fort Armstrong, the District established a Nike-Zeus office in Room 211 of Building 96 as early as May 1959 to serve as liaison for the Kwajalein and Johnston Island projects. Succeeding this office was the Missile Projects Branch set up later that year under the Construction Division, to administer the construction of Nike-Zeus facilities overseas. 1960 saw the installation of two teletype machines in HED's Office Service Branch for the transmission of messages between Honolulu and the Kwajalein Area Office.

From that office, opened in June of 1959 on Kwajalein Island, HED has administered the series of construction contracts awarded in Honolulu. Kwajalein's first Area Engineer, Lieutenant Colonel Walter P. Blum, supervised a staff of two officers and 27 civilians. Lieutenant Colonel Herman Brunke succeeded Lieutenant Colonel Blum and remained in Kwajalein until the spring of 1962, when the office was redesignated as a project office in line with the anticipated completion of the construction phase of Nike-Zeus. New developments in the Nike program led to the reestablishment of the Kwajalein Area Office in 1963, when Mr. Richard M. Brambley began a one year tour as civilian Area Engineer. Mr. Brambley served as Deputy Area Engineer beginning in 1964, then, while Major William L. Durham was Area Engineer; Mr. Brambley then became Acting Area Engineer for two months in 1966. Major Vernon K. Davis relieved as Area Engineer in March 1966, when the staff included over fifty civilians, while Major Heino J. Frey has headed the office since July 1968. Within the Kwajalein Area Office, too, were established various project offices, such as those existing in late 1967 for the defense



Map of Kwajalein Atoll, Marshall Islands, indicating major islands on which Nike facilities were constructed in the 1960's.

center complex, for Roi-Namur, for Kwajalein Island, and for Ebeye.

Project offices on Roi-Namur were established, deactivated, and restaffed periodically according to the pace of construction on that island. In March 1961, for instance, 17 HED employees were assigned to the Roi-Namur project. A similar pattern took place on Johnston Island during the early years of the Nike-Zeus program: the resident office established in July 1959 and staffed by Major Charles J. Davis and eight civilians was disbanded a year later as construction on that island drew to a close.

Among the effects of the Nike-Zeus construction program on the Honolulu District was a justifiable feeling of pride and self-importance. In August 1959 Chief of Engineers Major General Emerson C. Itschner visited Hawaii for two days and emphasized the large proportion of military funds being expended on Pacific missile range construction. Soaring contract amounts in the 1960's seemed to confirm the importance of the growing Nike program, while a National Press Tour in March of 1961 included Nike-Zeus and Project PRESS facilities at Kwajalein on its inspection of the Pacific Missile Range. Members of HED also made trips in connection with Nike-Zeus: in September 1959 the Assistant District Engineer for Nike-Zeus represented the District at a conference in Huntsville; in September 1960 the Chief of the Supply Division toured contractors' plants on the mainland. Engineers from HED visited Kwajalein as early as March 1959. The Division and the District Engineers also inspected sites at Kwajalein in March 1960 and on their next visit that December flew to Roi-Namur as well.

In many ways operations at Kwajalein recalled the Welles Harbor project at Midway over two decades earlier, for in similar fashion employees stationed on the remote island accepted their assignment with mixed emotions. Just as the men at Midway awaited the monthly mail delivery via Pan Am Clipper and joked about their isolation, so the engineers at Kwajalein longed for current newspapers from "Hono" and accustomed themselves to canned milk and frozen meat. Similarly, the high pitch of activity associated with HED's first long distance harbor project was matched now by the excitement expressed by the Kwajalein Area staff as they contributed to the vital Nike-Zeus program. The enthusiasm generated by the Kwajalein construction project was reflected in the Honolulu office as well, just as HED had caught the fever of Midway in the 1930's. "Kwaj" became a byword in Building 96 as the Honolulu District entered one of the most significant eras of its history.

HED's role in contracting for the various projects in the Marshall Islands forms a chapter in itself, for contract negotiations came to constitute an important part of the Honolulu District's work on the Nike program. In 1959 HED advertised for bids for the first increment of Nike-Zeus test facilities. This contract would include construction of the Zeus Acquisition Radar (ZAR) Antenna Foundation, the ZAR Receiver Building, the ZAR Transmitter Building, and Target Track Radar (TTR) no. 4. Low bidder of the 17 offerer firms was the joint venture of Pacific Construction Company, Ltd., of Honolulu; Reed and Martin, Inc., of Fairbanks; and the H. B. Zachry Company of San Antonio. On 30 June 1959, then, HED awarded contract DA-94-612-ENG-170 in the amount of the low bid, $3.26 million.

At the time of the initial contract award, the District guaranteed the contractor another $4 million to $10 million of construction for Nike-Zeus and also contemplated a third construction package, to be competitively bid. As construction progressed, however, new work was added by negotiation to DA-170. The urgency of the entire project, the presence of the contractor's men and equipment on Kwajalein, and Pacific-Martin-Zachry's proven ability to perform on schedule led to the District's decision to expand the existing contract rather than to advertise anew.

HED continued to add new work by negotiation so that by the spring of 1962, when construction under this contract was substantially complete, over 810 change orders had brought the contract amount to over $52 million. Among the new facilities added to the contract by that point were the ZAR and Battery Power Plants, launching areas, bachelors' quarters, mess halls, and sewers. DA-170 was a price redetermination contract with redetermination downward only. When the contract was redetermined on 30 September 1962, then, the contract amount of $53.9 million was reduced by $1.4 million and the contract was reestablished as a firm fixed price type contract. During the next three years HED added additional work by negotiation on a fixed price basis and on 30 December 1965 closed out the $58.61 million contract. DA-170's uncompleted work was then placed under a new fixed price incentive contract, DA-411.

Soon after the District had awarded DA-170, in 1959, the Engineers learned of plans for Project PRESS on Roi-Namur. Since the construction contractors for Nike-Zeus were already on Kwajalein, 40 miles to the south, and had been performing well, HED decided to negotiate the contract for Project PRESS with the same group. Reed and Martin and H. B. Zachry had bought out their partner, Pacific Construction, in early 1960, but had maintained the name of the joint venture as PMZ. The price redetermination contract awarded to PMZ on 9 November 1960 in the amount of $2.8 million called for the construction of the airfield at Roi-Namur, the equipping of a barracks ship, the erection of a contractor's camp and a water catchment area, as well as pest control.

Contract DA-94-612-ENG-260 followed a history similar to that of DA-170, as an important radar building, optical stations, and a computer building were among the items added to the original contract. On 30 November 1961 DA-260 became the first such Nike contract to be redetermined: the contract

amount was reduced from $19 million to $18.83 million, while work continued to be added on a fixed price basis until 3 July 1963, when the contract was closed out at $18.94 million. Subsequent contracts would cover additional construction for Project PRESS.

The slight drop in HED's overall workload in late 1962 and early 1963 and the redesignation of the Kwajalein Area Office as a project office were paralleled — and to some extent caused — by the apparent near-completion of Nike-Zeus construction in the middle of 1962. By late 1963, however, HED had received word of Nike-X construction to be performed at Kwajalein and began plans and specifications for a new contract for preliminary work on this project. Whereas the District had negotiated DA-260 with the current contracting firm, this time the Engineers opened the bidding to new contractors. Coincidentally, PMZ offered the low bid and thus continued to fulfill HED's construction programs in the Marshall Islands. Contract DA-94-612-ENG-362, signed on 3 February 1964 as a firm fixed price contract in the amount of $2,348,704, covered dredging and fill for new land for Nike-X facilities on Kwajalein and similar dredging and fill at Meck Island. When closed out on 26 October 1965, the contract totaled $3.66 million. Although DA-362 might be considered the "baby" of the four Nike contracts, it literally laid the groundwork for further construction of Nike-X facilities under contract DA-411.

While work continued under DA-362 on dredging for new Nike-X sites at Meck and Kwajalein Islands, in early 1965 the Pacific Ocean Division Engineer appointed the District Engineer chairman of an Ad Hoc Committee to determine contracting methods for future Kwajalein construction. OCE approved the committee's recommendation that, since the contractor had displayed outstanding performance in all work done so far, the same joint venture, now named Martin-Zachry Constructors, should be retained. As a result of the study, on 30 December 1965 the District closed out DA-170 and awarded a new, fixed price incentive contract to MZC for a Nike-X program whose eventual total cost was estimated at $65 million. On 30 December 1965 carry-over and negotiated work totaled $3.39 million; as of 1 January 1970 the contract amount stood at just over $66 million.

Under DA-94-612-ENG-411, then, MZC has constructed Nike-X, Sentinel, and Safeguard facilities on Kwajalein and Meck. The principal subcontractors involved in both the Zeus and X programs have included American Electric Company, Hondeen Coatings, Honolulu Roofing Company, and the Atlas-Lillie Company of Honolulu, and Massart International and Leckenby Structural Steel Company of Seattle. Throughout all phases of the Kwajalein construction program, HED has repeatedly expressed satisfaction with the contractor and has prided itself on its good relations with Martin-Zachry. Together the District and MZC have overcome the many obstacles inherent in this type of project.

The nature of these defense programs required great flexibility, first of all. During construction at the Marshall Islands, improvements developed at stations in Whippany, New Jersey, and White Sands, New Mexico, were relayed to Kwajalein, for example, so that by the spring of 1962 the Engineers had made over 22,000 drawing changes for Nike-Zeus and over 4,000 for Project PRESS. The scope of the program demanded flexibility, too, for HED's responsibilities ranged from the construction of precise rings for revolving antennas to the paving of airstrips and the erection of bachelors' quarters. And where were the construction workers to sleep and eat while the dorms and messes were being constructed? The speed demanded of construction for this crash program meanwhile underscored the Engineers' problems.

Nor did the islands' environment make life easier for HED and the contractors. Southwesterly winds with high tides tended to "pile up" the water in the lagoon; in November 1962 and again in October 1965, high water caused flooding and displacement of riprap along the shoreline and piers. The Engineers soon learned that the brackish water underlying the islands made excavating to more than five feet in depth extremely difficult. The water attacked buried metal, too, so that valves and fittings of underground utilities corroded rapidly. Constant humidity averaging 82 per cent called for air-conditioning in all facilities, not only for comfort but also for the proper operation of technical instruments. The humidity and high salt content of the atmosphere tended to corrode buildings and equipment, which thus needed continuous maintenance. Spare parts rusted quickly and had to be replaced often. Since aluminum flashing on roofs would not stand up in the Kwajalein environment, the Engineers turned to more expensive, less accessible stainless steel flashing. Blasting through coral reefs to obtain aggregate and avoiding the live World War II shells buried underground further challenged construction workers in Kwajalein.

The atoll's isolation presented other problems, too. Most cargo arrived by surface vessels, with lead time for procurement usually figured at two to three months. Priority operations in Viet Nam after 1965 made shipping schedules to Kwajalein uncertain and warehousing of parts and supplies a necessity. The warehouses had to be dehumidified, furthermore, to protect electronic equipment while in storage. Shipments to other islands up to 50 miles away required additional manpower and time to store and reship supplies from Kwajalein Island. Even before the buildup in Viet Nam, the logistics of shipping created problems: in late 1960 two contractor's barges carrying lumber, mobilization equipment, small tools, and asphalt intended for the runway sank en route to Roi-Namur. These varied and difficult conditions under which HED and MZC operated in Kwajalein illustrated the often-unusual

work performed by the Honolulu District. In spite of the obstacles encountered in Kwajalein, success and satisfaction marked every phase of the construction program for Nike research and development in the Marshall Islands.

That construction program fell into three stages delineated by the projects themselves. First underway was Nike-Zeus, construction for which began as early as 1959 and which included work on Johnston Island as well as at Kwajalein. Project PRESS started in 1960 and has run concurrently through both the Nike-Zeus and the Nike-X programs, with most work located on Roi-Namur. Succeeding Nike-Zeus, then, was Nike-X, which has continued as Sentinel and Safeguard.

Construction of Zeus-related facilities on Johnston Island would have constituted a major chapter in HED's Nike history had new developments not halted this aspect of the program soon after work began. The original plan called for the firing of IRBM's from Johnston Island. In preparation for these shots, the resident office established there in July 1959 would supervise the construction of launch pads, cable tunnels, high pressure gas storage and handling facilities, liquid oxygen storage tanks, communications systems, and other technical and support facilities. In addition to this work to be performed under DA-170, a separate contract with Wayne Construction, Inc., and Reed and Martin, Inc., signed in June 1959, provided for harbor dredging operations whose fill would create over 23 acres of new land. In June 1960 the Government paid the contractor $757,747 for dredging and placing work.

Major Davis's tongue-in-cheek reports from his resident office at Johnston Island delighted the staff in Honolulu. "31 October 1959," he wrote:

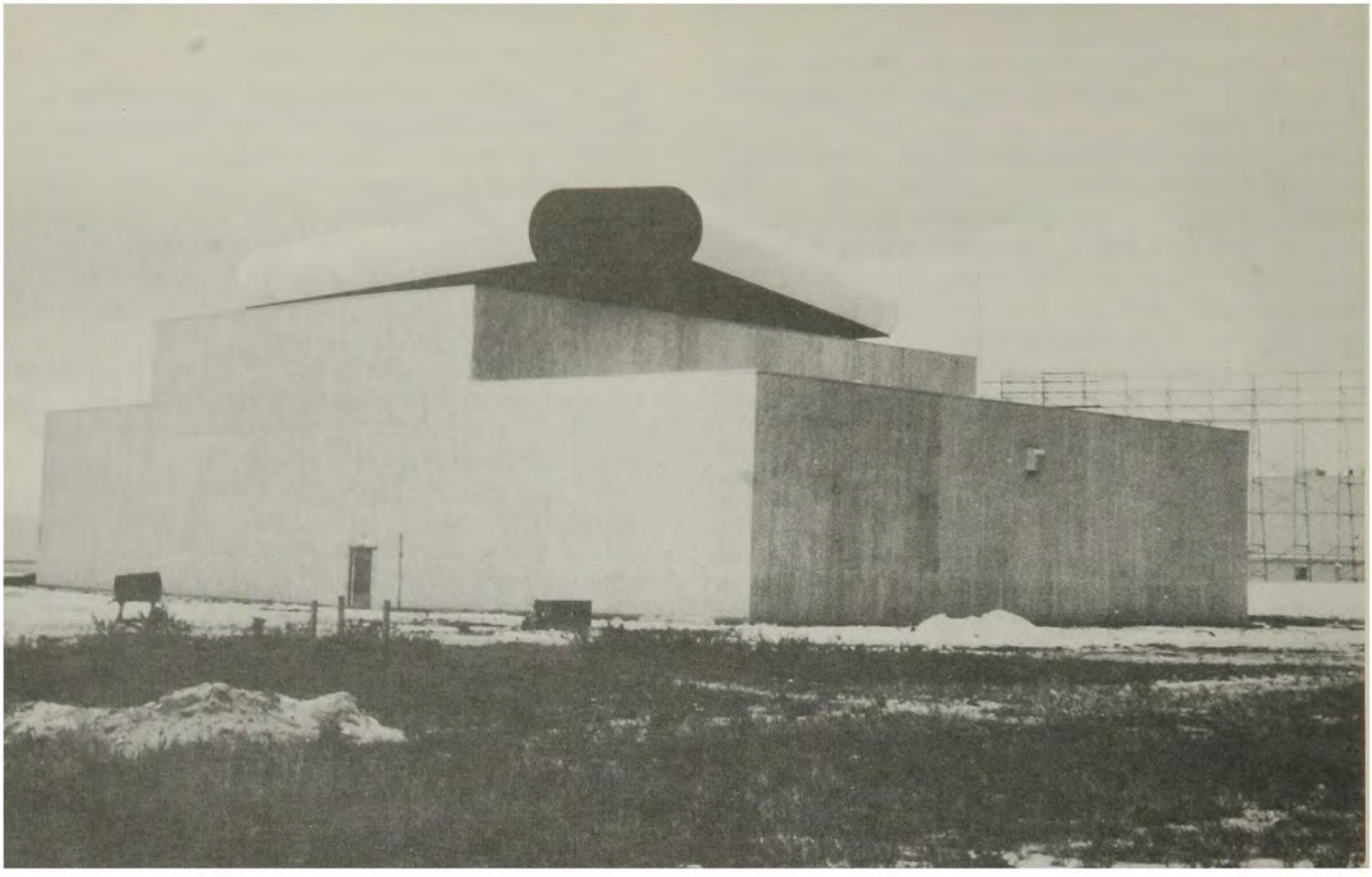
> Saturday night over here, and your reporter stepped out on the town and had a hamburger and cup of coffee at the local night spot (Base Club) in celebration of — TGITEOAM (a local Air Force term meaning — Thank Goodness It's the End of Another Month.) TGIF is not used in the Resident office, since the contractor is now working 22 hours a day, 7 days a week. Watching the dirt roll in for the new real estate being created here is not the most exciting thing in the world, but every now and then we encounter some mild excitement. One man has been shipped off the job as a suspected mental case (not from the Resident office, however). High tides accompanied by heavy winds have been tending to wash away the contractor's causeway cut into the borrow area. The salt water sewage system on the base breaks down at the most inconvenient times. Water is off 4 hours a day as an economy measure, and at other unscheduled times as the evaporators see fit to give out. Part of the roof started to blow off the Resident Office this morning, but have it tied down now with wire . . .[1]

Major Davis's informative and often humorous reports gave HED employees back home a good picture of progress at Johnston Island.

Dredging at Johnston began in the summer of 1959, as construction workers built a 3,500-foot causeway which would be used in subsequent fill operations. As in Nike-Hercules construction on Oahu, the contractor's equipment fascinated District employees on Johnston; of special interest to Major Davis was a Manitowoc 4500 crawler mounted dragline capable of dredging 6,000 cubic yards per 20 hour day. Work at Johnston continued through the winter and spring of 1960, when a Department of Defense decision to fire ballistic missiles from California rather than from Johnston Island signaled the end of this phase of IRBM construction. On 6 June 1960 the contractor wound up the dredging and fill operations, which had produced over 23 acres of land; on 14 June the Resident Engineer disbanded his office; and on 28 June the contractor completed demobilization. The attention of the Honolulu District now shifted from dredging at Johnston Island to construction in the Kwajalein atoll.

While associated facilities were built on the islands of Gugeegue, Ennylabegan, and Roi-Namur, most of the construction for Nike-Zeus took place on Kwajalein itself. As part of its initial site preparation the District paid the R. N. Towill Corporation of Honolulu $83,950 for geodetic surveys and the preparation of topographic maps of the islands in early 1960. Other preliminary site work included repairing, cleaning, and extending the fresh water distribution system, rehabilitating 14 one-million-gallon concrete tanks and constructing a new tank of the same size, and expanding the sea water system. The contractor also rehabilitated the petroleum oil and lubricants system at Kwajalein. Quarrying operations centered at sites on the ocean side of Kwajalein Island until early 1962, when the contractor transferred quarrying equipment to South Loi.

Construction of the technical and community structures at Kwajalein began in August 1960 and was essentially complete two years later. At the center of the technical facilities built on the western end of the island lay the ZAR complex, which included the Transmitter Building and Shielding Fence; the Receiver Building, Antenna Foundation, and Ground Plane; and the ZAR Power Plant, all of which were constructed by the end of 1961. A 102-foot by 140-foot reinforced concrete structure, the ZAR Transmitter Building housed three floors of electronic and mechanical equipment and since the end of the Zeus program has been used for dehumidified storage. Completely surrounding the Transmitter Building was the Radio Frequency Shielding Fence; 60 feet high and 690 feet in diameter, the fence was covered with 130,000 square feet of monel metal and stainless steel. The ZAR Receiver Building located



ZAR Transmitter Building, Kwajalein.

ZAR Radio Frequency Shielding Fence, Kwajalein.

nearby contained 22,225 square feet of floor space. PMZ also constructed a Receiver Antenna Foundation of reinforced concrete with a massive inner core 36 feet in diameter and an enclosure wall 100 feet in diameter. The Ground Plane, a structural steel assembly 600 feet in diameter and 32 feet above grade, was covered with 275,000 square feet of wire mesh, which acted as a reflective surface. While the transformation of Nike-Zeus into Nike-X rendered many of these facilities obsolete and converted others into dehumidified storage areas, the ZAR Power Plant has continued in operation as Base Power Plant no. 1. This 31,080-square-foot steel framed building was constructed to supply power to the ZAR transmitter and receiver elements with nine 1,500-kw diesel engines. These transmitter, receiver, and power facilities made up the vital ZAR complex of Nike-Zeus.

HED supervised the construction of other technical facilities on western Kwajalein in addition to these ZAR components. In 1961 PMZ built four 60-foot deep reinforced concrete launch cells and set them in a mounted fill of approximately 200,000 cubic yards of compacted earth which was soon dubbed "Mt. Olympus." Nearby, the contractor mounted on steel towers three camera stations which housed closed circuit TV equipment for monitoring launch operations. Two of the launch cells would be modified later to accommodate Spartan missiles. Workers completed the 9,302-square-foot Target Track Radar no. 4 in 1960 and finished TTR no. 5, 8,661 square feet in area, in 1962. A 250-foot wave-guide structure connected the two shielded buildings, while a half mile of similar wave-guide structure joined TTR no. 4 to a TTR boresight tower over 100 feet tall. Last of the radars built in the first increment of construction was the Discrimination Radar, a 38,971-square-foot steel and reinforced concrete structure supporting a 38-foot diameter radome on its roof.

To supply power to the TTR's, the DR, the missile launch area, and the Battery Control Building, in 1961 the contractor built a 21,248-square-foot Weapons Battery Power Plant with six 800-kw diesel

ZAR Power Plant, Kwajalein.

engine-generator sets. The Battery Control Building, an 11,801-square-foot structure, was also completed that year, as were a diesel fuel tank, a salt water pump house, and a salt water intake structure. HED's Nike-Zeus construction program on Kwajalein thus consisted primarily of these technical components: the ZAR complex, the missile launch area, radar structures, and power producing plants.

Among the closely related facilities built at the same time was the Joint Technical Operations Building, a two-story steel framed concrete block structure with a floor area measuring approximately 62,000 square feet. Offices of KMR and the contractor, a workshop, and storage areas occupied this facility. Two 4,000-square-foot warehouses were also built in 1960, while three years later the contractor constructed two additional, dehumidified warehouses each 6,000 square feet in area. Communication and instrumentation facilities on Kwajalein included several optical stations and a photographic laboratory; the lab was converted from an existing Navy communications building, remodeled, and air-conditioned to house complex photographic equipment.

As these technical structures took shape in the western and central areas of Kwajalein, from 1960 to 1962, community and support facilities were being constructed on the eastern half of the island. 374,000 cubic yards of fill plus riprap on the shore created an additional 20 acres of ground along the lagoon on the northern end of Kwajalein for a mobile homes park; the contractor installed 73,000 linear feet of underground utilities and 257 family trailers on the new land. The housing program included quarters for bachelors, too; the three 3-story buildings constructed by PMZ contained a total of 208 rooms for 500 men, were completely air-conditioned, and of-

Launch facilities constructed for Nike-Zeus on the western end of Kwajalein.

fered a separate toilet and shower for each pair of rooms. Also added to contract DA-170 was a 20-room dependents' school of hollow-block construction. The Kwajalein Area Office supervised the construction and rehabilitation of recreational facilities, too, as the Yokwe Yuk Club and mess hall were expanded and remodeled and a new Pacific Club was erected for the island's bachelors. A beach pavilion with picnic shelters completed in 1962 and a Teen Center built in 1963 rounded out the construction program of community facilities related to Nike-Zeus.

The following list of DA-170 contract amounts indicates the relative construction costs of the various Nike-Zeus projects on Kwajalein.

Item	Contract amount
Area Work	
Site preparation, roads, earthwork	$ 895,000
Utilities, fresh and sea water supply and storage	791,000
ZAR Complex	
Receiver Antenna Foundation and Ground Plane	3,042,000
Transmitter Building and Beam Forming Fence	$3,163,000
Receiver Building	1,121,000
Power Plant, pumphouse, and facilities	4,243,000
Missile Complex	
Target Track Radar Building no. 4 and boresight tower	1,200,000
Target Track Radar Building no. 5	1,622,000
Discrimination Radar Building and R. F. Shielding Fences	4,722,000
Battery Control Building and Missile Track Radar	1,220,000
Launch cells, live storage, assembly and inert bays	1,977,000
Power Plant, pumphouse, and facilities	2,544,000
Communication and Instrumentation	
Optical and camera stations	2,863,000

Target Track Radars No. 4 and No. 5, Kwajalein.

Telemetry structures	220,000
Airborne instrumentation laboratory	180,000
Administration Facilities	
Joint Technical Operations Building	1,979,000
Navy communications building	$ 650,000
Navy operations control center	493,000
Photographic laboratory	685,000
Security structures — fences and control stations	532,000
Housing and Support Facilities	
3 bachelor quarters buildings	3,985,000
Site and facilities for 257 family mobile homes	3,020,000
New school	722,000
Underground power, lighting, and telephone	1,736,000
Rehabilitation of existing housing, mess hall, and service buildings	2,234,000
Rehabilitation and expansion of POL tanks, pumps, and piping	582,000
Major addition to station power plant	1,604,000

Also provided for in the same contract with Martin-Zachry was the concurrent construction of Nike-Zeus instrumentation and communication facilities on the islands of Gugeegue and Ennylabegan in the Kwajalein atoll. The final contract amount for construction on Gugeegue totaled $3,355,000 and that for work at Ennylabegan, $3,708,000. At both locations, in 1961 workers built power plants: that on Gugeegue measured 4,045 square feet in area and housed three stationary 500-kw diesel engine-generator sets; Ennylabegan's was 2,668 square feet in size and produced power by four stationary diesel engine-generator sets of 200 kw each. Gugeegue hosted the Transmitter Building, a 110-foot by 74-foot single floor concrete block

The Battery Control Building, Kwajalein.

structure, while Ennylabegan was the site of the 3,243-square-foot Receiver Building also constructed in 1961. On both islands construction crews built housing and messing facilities, optical stations, water catchment areas, and water storage tanks. Construction at these islands presented even more problems than did work on Kwajalein proper, for supplies had to be shipped from Kwajalein and Ennylabegan's dense jungle growth had to be penetrated before work could begin.

Nike-Zeus construction in the early 1960's also extended to the island of Roi-Namur. Project "Speedball," as this aspect of Nike-Zeus was known, called for the firing of smaller, Speedball rockets from Roi-Namur prior to the launching of Atlas missiles from California. 1961 saw the construction under DA-170 of two live storage areas, one live assembly bay, and a Speedball launch pad in the northwest corner of Roi-Namur. The construction of the Speedball missile complex on Roi-Namur cost approximately $645,000.

The extensive construction program on Kwajalein Island and the building of these additional facilities on Gugeegue, Ennylabegan, and Roi-Namur heralded the Honolulu District's full-scale participation in the Nike-Zeus program. Closely associated with Nike-Zeus was Project PRESS, the Pacific Range Electromagnetic Signature Studies program whose facilities were located primarily on Roi-Namur. Although HED had learned of plans for Project PRESS in late 1959, slow funding delayed the contract awards until the fall of 1960. At that time the District signed DA-260 with Pacific-Martin-Zachry and an additional contract for design of support facilities with a mainland firm.

Within days after the award of DA-260, the contractor's men and equipment arrived at Roi-Namur. Construction here presented even more problems than had similar work at Kwajalein itself, for while at Kwajalein the Engineers could utilize and rehabilitate existing structures, at Roi-Namur only a coral airstrip and a dock dotted the landscape. The Following table of contract amounts as of June 1962 indicates that a significant proportion of funds was expended on site preparation and mobilization.

Aerial view of Roi-Namur Island, Kwajalein Atoll, taken in 1967.

Item	Amount
Area Work	
Utilities, mobilization, and contractor's camp	$3,375,000
Preliminary site work, roads and paved area	642,000
Airfield	736,000
Support Facilities	
Dormitories and mess hall	2,160,000
Administration and service structures	$1,052,000
POL storage and distribution	263,000
Dock and harbor work	342,000
Fresh water supply, storage and piping	876,000
Sea water distribution system; sanitary sewers	1,218,000
Technical Facilities	
TRADEX Building, optical tracker and boresight towers	3,744,000
Computer building	758,000
Optical stations	527,000
Power Plant and installation of equipment	1,438,000
Power distribution and communication systems	1,634,000
Station keeping radar	435,000

As this table points out, utilities, mobilization, and the contractor's camp cost almost as much as the construction of the major technical structures. The lack of existing facilities on Roi-Namur not only required greater expenditures on site preparation, furthermore, but also created additional work and many problems for both HED and PMZ. One of the first tasks facing construction workers, for instance, was the repair of the old causeway which had connected Roi and Namur during World War II. Since supplies could be transferred conveniently from one section of Roi-Namur only via this rehabilitated roadway, its reconstruction was rushed to completion during the first few months of 1961. Another problem concerned the lack of housing and messing facilities: where would the construction crews sleep? To solve this matter, HED arranged for the Naval Shipyard at Pearl Harbor to rehabilitate a barracks craft under the supervision of Honolulu District personnel. In late November 1960 APL-24 sailed with stores and contractor's equipment for Roi-Namur, where the vessel would serve as "home" for construction workers.

Other vessels carried additional supplies and personnel to Roi-Namur, for until the airfield was reconstructed all material had to arrive by ship. On 29 November 1960 the **Maui Queen** landed with two welcome cooks; in December the landing ship **Sally** brought her first load of gravel and equipment from Kwajalein and during the next few weeks made at least three more aggregate-loaded trips. That fall the tug **Martin** left Honolulu towing two barges laden with PMZ construction material destined for the project at Roi-Namur. Rough seas capsized one of the barges, whose sinking then necessitated cutting loose the second barge as well. Although the loss did not delay the completion date for Project PRESS construction, the incident did illustrate the difficulties involved in transporting supplies to the remote island.

Also of immediate importance in preparation for the construction of Project PRESS facilities, in addition to the repair of the causeway, the rehabilitation of APL-24, and the shipment of supplies and equipment, was the reconstruction of the airfield at Roi-Namur. Here, too, the lack of an existing alternate runway complicated construction, since the workers had to open a temporary runway for use while the main pavement was being resurfaced. By January 1961 the contractor had removed over ninety coconut trees from the airfield; in May of that year the paved runway was opened to air traffic. Airfield facilities constructed at Roi-Namur in 1961 included the 4,500-foot-long, 150-foot wide runway; 6,112-square-yard taxiways; and a 1,010-square-yard apron.

The construction of community support facilities rated almost as high a priority as did the airfield rehabilitation, again because no such structures existed prior to Project PRESS. While contractors on Kwajalein could use the old air terminal, for example, workers on Roi-Namur started from scratch and in 1961 constructed an 8,400-square-foot terminal building which also housed administrative offices. Several warehouses, diesel fuel storage tanks, and plumbing, electrical, and paint shops were built in 1961 and 1962. The contractor erected a set of bachelors' quarters as well as four concrete block dormitories for 144 men. Additional community facilities constructed at Roi-Namur in the early 1960's included a 5,271-square-foot dining room which could seat 150; a club; a fire station; and a retail store. In all these instances, new construction rather than rehabilitation characterized work at Roi-Namur.

The reconstruction of the airfield, the construction of dorms and warehouses, and other aspects of preliminary or support work at Roi-Namur laid the groundwork for the erection of the technical facilities which were the heart of Project PRESS. Most important of these was TRADEX, the Target Resolution and Discrimination Experiments Radar described by PMZ as "the pulse of the whole installation."[2] This steel-framed building measured 182 feet by 170 feet by 30 feet and when completed housed a dish-antenna tracking radar mounted on a heavy concrete pedestal. A week after the contractor's representatives at Roi-Namur received the plans for construction of the TRADEX Building, in late November 1960, workers began clearing the site. Dozers soon uncovered three concrete structures identified as 150-ton foundations for large guns; on the advice of the U.S. Engineers the contractor removed two of these structures and took the

TRADEX Building on Roi-Namur, 1962.

other one to 18 inches below grade. Drilling, blasting, and pouring followed the excavation of the site until on 2 May 1961 workers erected the first steel at the TRADEX Building. The rest of the year saw continued shielding, carpentry, and mechanical operations.

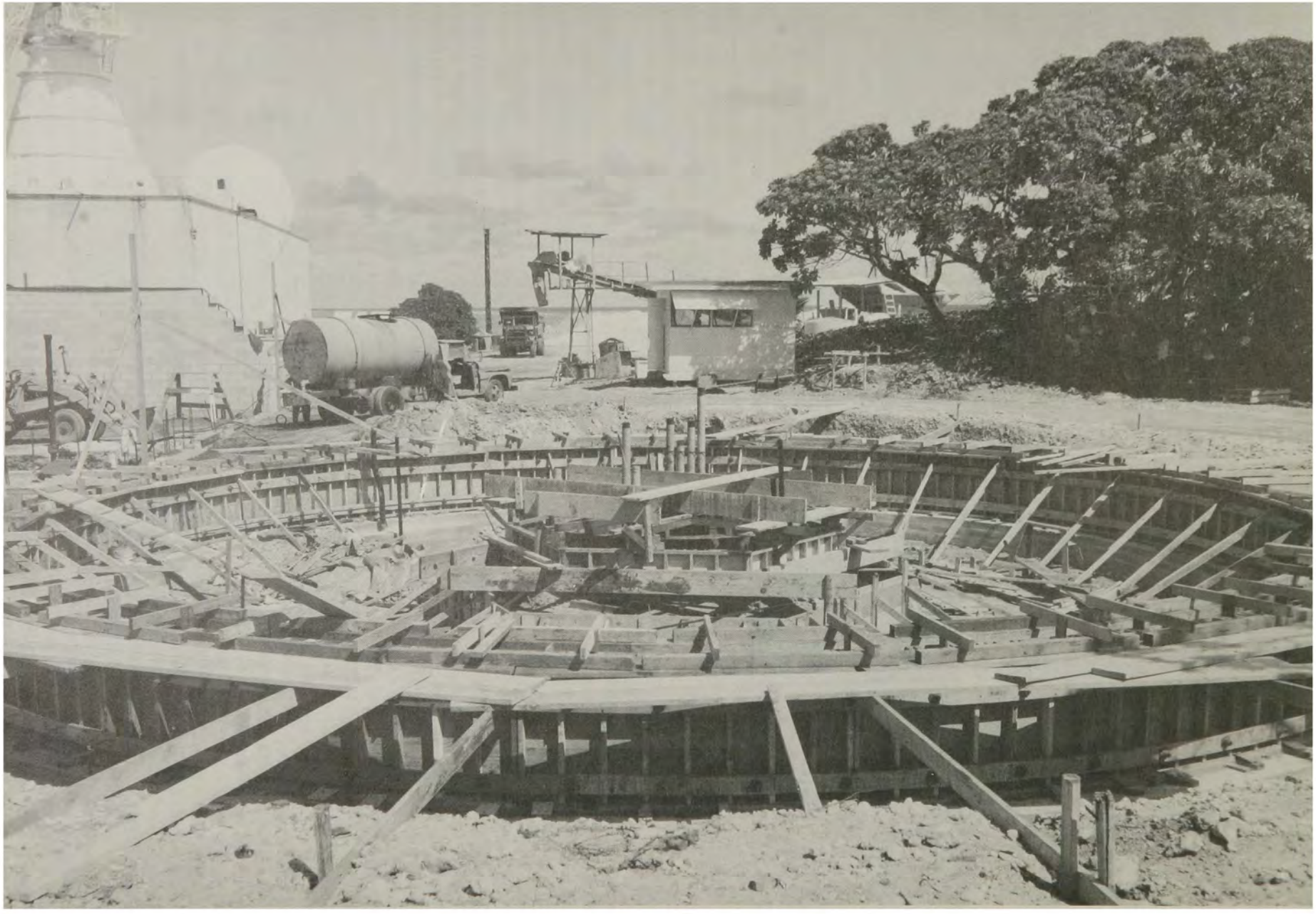
Associated with TRADEX were two boresight towers: the one constructed on Roi-Namur was 218 feet tall, while that built on Ennurgarret Island, approximately 6,000 feet away, measured 264 feet in height. Contract DA-260 also called for the construction of a 1,200-square-foot optical station and three station keeping radars on Roi-Namur. The PRESS Computer Building, a 114-foot by 75-foot single floor shielded structure connected to TRADEX by a 60-foot shielded tunnel walkway, was completed in 1962; a 5,000-square-foot section of its floor was mounted on movable jacks. Producing the power for these various radar installations on the island was the Roi-Namur Precise Power Plant, a 10,546-square-foot building constructed in 1962.

The Project PRESS facilities on Roi-Namur were thus erected concurrently with Nike-Zeus construction on Kwajalein from 1960 to 1962. Although contract DA-260 for Project PRESS was closed out in July of 1963, work on this and related programs continued into the Nike-X era under DA-411. Among the structures erected as part of Project PRESS after 1965 was the GLOW Building, a 2,742-square-foot instrumentation and administration building constructed on Kwajalein Island in 1966 for an ARPA project related to Project PRESS. An optical station was built around the same time on Roi-Namur to house a 48-inch telescope and two associated mirrors. The two largest complexes constructed on Roi-Namur since 1965 have been for Project ALTAIR (ARPA Long-range Tracking and Instrumentation Radar) and for Project ALCOR (ARPA Lincoln C-band Observable Radar), programs of the Advanced Ballistic Missile Defense Agency (ABMDA). For ALTAIR, the contractor built a 31,170-square-foot building, an additional utility building 620 square feet in size, a tunnel from the main building to beneath the center of the antenna, and the ALTAIR radar antenna itself, a concrete foundation supporting a steel dish 150 feet in diameter. These facilities were completed in 1967, while the following year saw the construction of similar structures for ALCOR. The main ALCOR building measured 9,746 square feet and the warehouse 4,000 square feet; the dome-shaped radar antenna rested on a concrete foundation. Although the major portion of Project PRESS construction was completed under DA-260 by July of 1962, then, contract DA-411 provided for the subsequent construction of associated facilities and additional discrimination radars on Roi-Namur.

The completion of the first increment of Project PRESS construction under DA-260 coincided with the conclusion of the Nike-Zeus construction program provided for in DA-170, for in July of 1962 the Army successfully fired a Zeus missile from Kwajalein. The same tests which confirmed Zeus's accuracy, however, also disclosed its weaknesses and resulted in the decision not to proceed with deployment of the Nike-Zeus system. Instead, in early 1963 the Department of Defense began plans for developing and testing Nike-X, a low altitude interception system whose Sprint missiles would weigh approximately half of the old Zeus weapons.

Once again HED found its workload keeping pace with trends in national defense. Just as the original Nike-Zeus research and development program had launched the District on a $50-million project, now the completion of this phase of Zeus was largely responsible for the decline in the District's activities in late 1962 and early 1963, when the Kwajalein staff maintained only a project office and certain functions of HED in Honolulu were transferred to POD. This lull in turn lasted less than a year, as the District responded to the next phase of the Nike program in late 1963.

Even before Defense had made a firm decision to proceed with construction of Nike-X research and development facilities, HED received word to begin site preparation for the new project. Contract DA-362, awarded to Martin-Zachry on 3 February 1964, provided for dredging and filling on Kwajalein and Meck, clearing Meck Island and dredging a channel there, and stockpiling aggregate at South Loi. Work on Kwajalein at first focused on dredging and filling 55 acres at the western point of the island for the multifunction array radar (MAR) II site. Sewers,



Antenna ring under construction for ALTAIR on Roi- Namur.

storm drains, and salt water return lines as well as riprap for the entire fill area were included in this portion of the project. The contractor then placed fill on the eastern end of the island to create a 38-acre "contingency fill" area which would serve as a trailer park when the Nike-X program expanded over a year later. The contractor also dredged the inner harbor at Kwajalein in the summer of 1964.

Similar jobs at Meck Island, approximately 19 miles to the north, were preceded by extensive clearing and grading operations. PMZ then dredged the lagoon side of the island and added the Meck Island fill. To procure the armor stone needed to protect the fills on both Kwajalein and Meck and the additional stone required for groins at both islands, in July of 1964 HED added a supplemental agreement to DA-362 to provide for the production and stockpiling of aggregate on South Loi, which had served as a quarry site for Nike-Zeus since 1962. This modification increased the contract amount by $223,000; when closed out in October 1965, DA-362 totaled $3,660,837.

This relatively small contract, then, set the scene for construction of Nike-X testing facilities on Kwajalein and Meck. As site preparation neared completion in the fall of 1965 the Honolulu District began planning for a new stage in Nike construction in the Marshall Islands and on 30 December 1965 transferred the remaining work under DA-170 to the new MZC contract, DA-411. Subsequent work would raise the amount of this contract from its original $3.4 million to over $66 million by January 1970. Also in preparation for the expanded Nike-X construction program, in November 1965 HED organized a MAR II Plant Resident Office to administer procurement for the MAR II Power Plant. A year later this office was redesignated the Nike-X Power Plants Resident Office and was assigned the new MAR II Power Plants Project Office and the Meck Island Power Plants Projects Office at the same time. The Nike-X

Aerial view of Kwajalein Island, July 1964, showing placement of MAR II fill on western (upper left) end of island and of contingency fill on eastern (upper right) end of island.

South Loi Island, Kwajalein Atoll, site of quarrying operations for Nike construction.

Meck Island, Kwajalein Atoll, in 1963, before clearing and grading operations and fill placement had begun.

Meck Island in 1967, after clearing, grading, fill placement, and partial construction of Nike-X facilities.

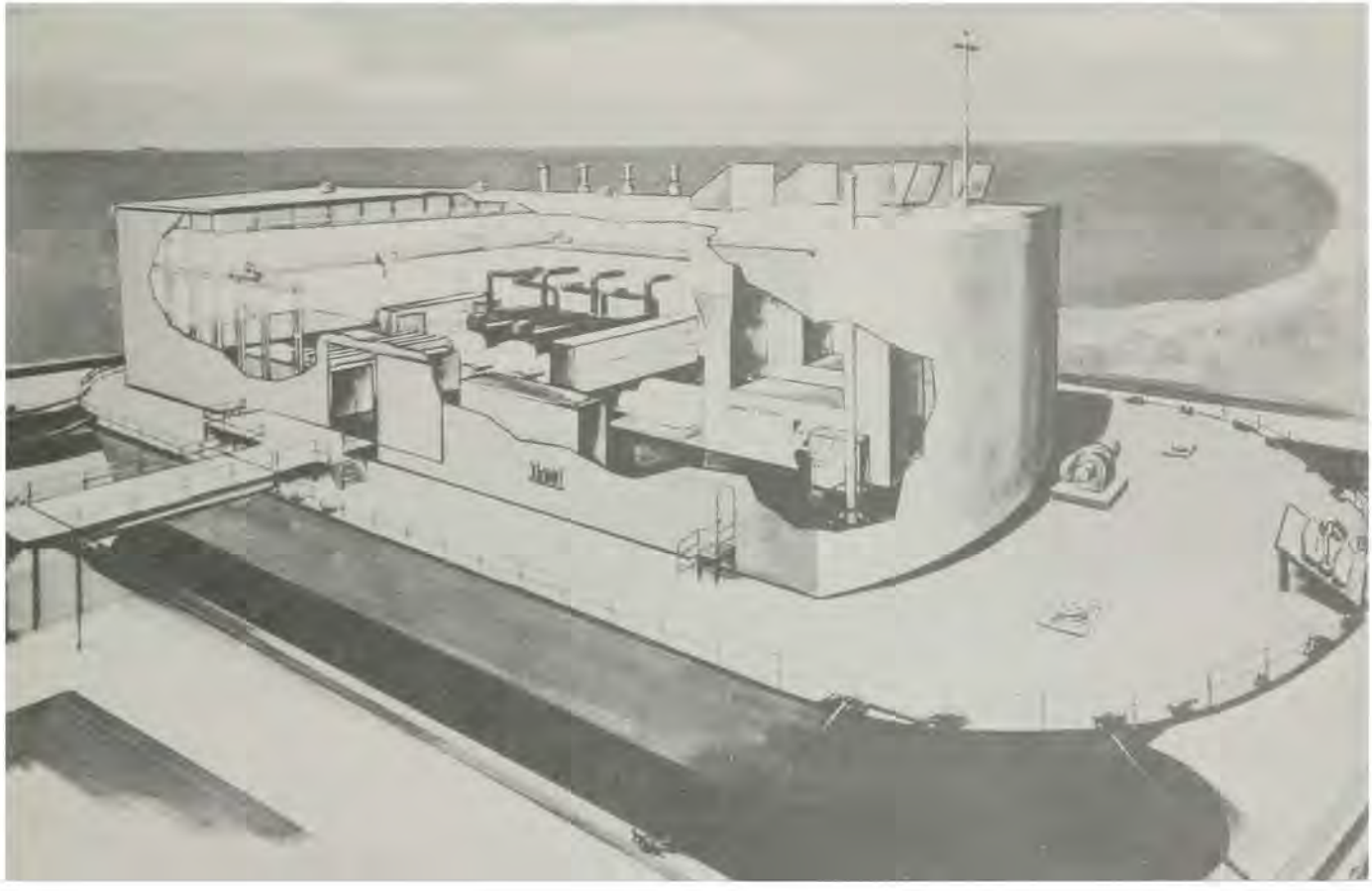
Power Plants Resident Office became a branch of the Construction Division in January 1968. The Kwajalein office meanwhile had regained its area status in 1963.

Although the basic principles of missile tracking and interception remained the same for Nike-X, certain features of the new program required new construction at Kwajalein and the conversion of facilities originally built for Nike-Zeus. The Defense Center Control Building (DCCB), for instance, would house the new multifunction array radar capable of locating the incoming missile; new Missile Site Radars (MSR) would then guide Sprint missiles to interception with the incoming weapon. Attracting the most attention of all the new facilities was the DCCB, the reinforced concrete structure erected on the new MAR II fill. Overall height of the building was set at 125 feet; the upper floors were to house electronic equipment associated with the radars; while antennas would be mounted in the sloping sides. Construction of the DCCB began in the spring of 1967. In June 1968, however, changes in the Nike-X research and development mission halted work on the building. Subsequent alterations in the Nike-X testing program resulted in the redesign of the DCCB as the CAMAR Building, which was to house a combined aperture multifunction array radar. The CAMAR project has likewise since been terminated.

Changes ordered in the Nike-X program in 1968 also affected one of HED's most interesting projects and resulted in the District's involvement in operations at the Panama Canal. Contract DA-94-612-ENG-422, awarded in May of 1966 to General Electric Company, provided for the design and manufacture of a MAR II Floating Power Plant, which was to provide 21.7 million watts of power by means of three 1,650-kw diesel generator sets and two 8,400-kw gas turbine sets. Major components of the power plant were manufactured at various locations on the mainland and the equipment was installed on a World War II floating dry dock at Baltimore, Maryland, in 1968. As the barge was transitting the Panama Canal en route to the Marshall Islands in June of that year, however, the Secretary of the Army ordered the Power Plant redeployed to provide power to the Canal, and its operations at Kwajalein were canceled. The Nike-X Power Plants Branch of HED then managed the operation of the MAR II Power Plant at the Panama Canal for the Chief of Engineers from 1968 to Spring 1970, when the management of the barge and the operation of the plant were transferred to OCE.

As a result of its role in the Nike-X program at Kwajalein, then, the Honolulu District found itself involved in a new project almost halfway around the world in the opposite direction and thereby acquired the largest geographic range of operations of all dis-

Drawing of MAR II Floating Power Plant.



tricts in the Corps. The opening of the Panama Canal over fifty years before had influenced HED's early history; now the power requirements of the Canal in 1968 once again shaped the work of the Honolulu Engineer District.

Most other new Nike-X work planned for Kwajalein did see construction on the island soon after 1965. Two new bachelors' quarters buildings were erected between 1965 and 1968; the contractor also installed 200 house trailers on the contingency fill site created under DA-362. The Kwajalein Area Office took special pride in the construction of a junior-senior high school complex which enabled U.S. dependents to complete their secondary education on the island. Quarrying operations also resumed at Kwajalein, as workers gathered riprap from the ocean coast for use along the lagoon side shore.

Just as important as the construction of new facilities was the conversion of structures originally built for Nike-Zeus. Two of the four launch cells at Mt. Olympus were enlarged when Spartan missiles joined the Nike-X program, while the DR and the TTR's located nearby were modified for purposes of reentry measurement. The ZAR and Weapons Battery Power Plants turned to the production of power for the entire island as well as for the growing complex of Nike-X facilities. Other buildings needed little rehabilitation but could serve Nike-X as they were: the ZAR Receiver Building, for example, became a storehouse in the early stages of Nike-X construction.

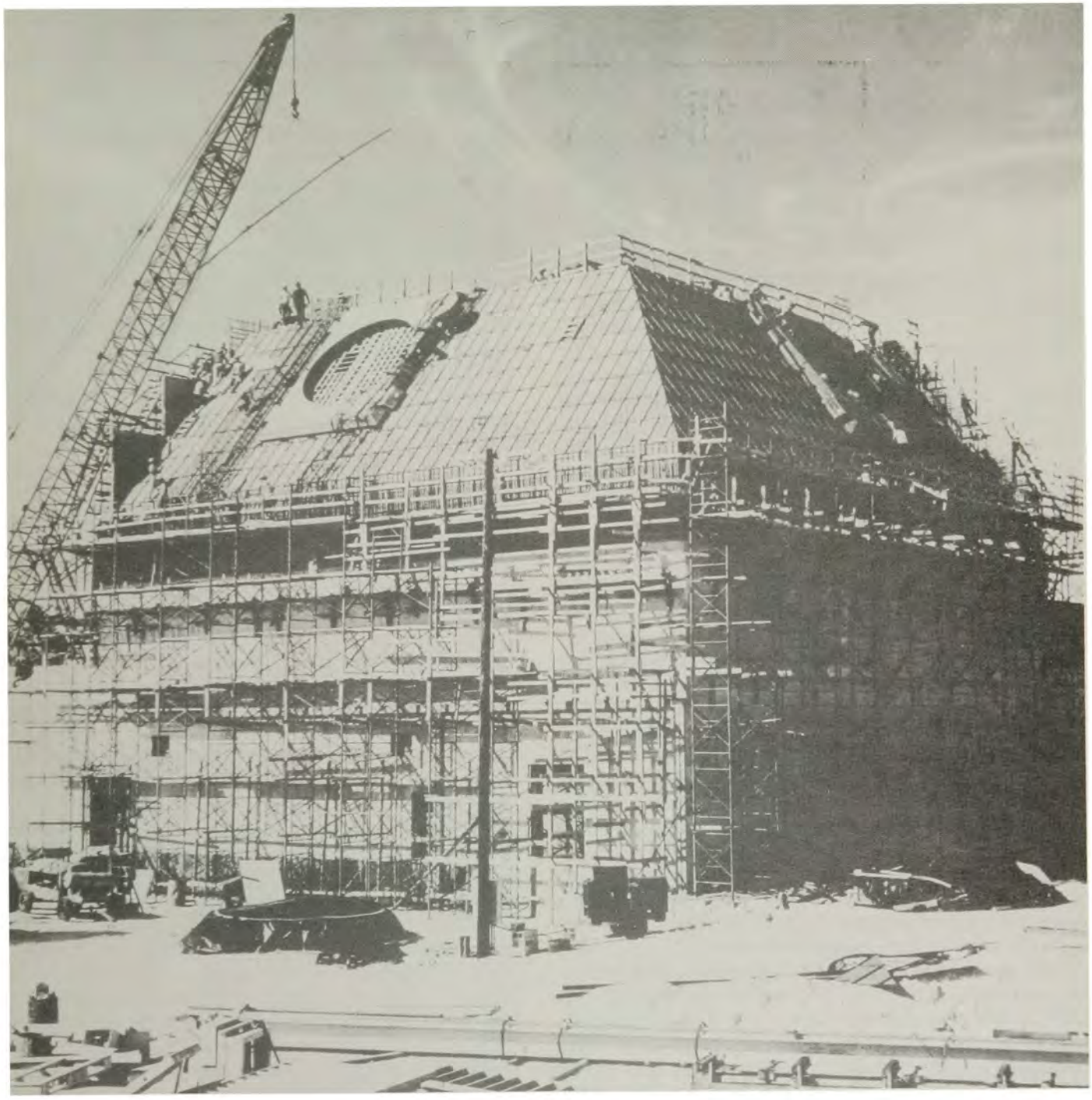
Several of the more important Nike-X facilities planned for Kwajalein found counterparts on Meck Island. Paralleling the DCCB was the Meck Island

Construction of Meck Island Control Building, September 1967.

Control Building (MICB), a reinforced concrete structure with a total floor area of 73,400 square feet. The MICB housed the Missile Site Radar (MSR) and other related facilities. To serve the MICB, in 1967 HED contracted for the construction of the 14-million-watt Meck Island Power Plant, and both the MICB and the Power Plant were completed in 1968. Workers on Meck also built a 1500-foot long aircraft runway and an adjacent apron in 1967, constructed a warehouse and an administration building at the same time, and in 1968 had begun work on the Meck Island launch complex for Sprint and Spartan missiles. The major thrust of Nike-X construction thus seemed to shift at the end of the 1960's from Kwajalein to Meck.

Other islands in the atoll have seen recent Nike-X construction, too. On Roi-Namur, Project Speedball facilities were modified; on Ennylabegan and other small islands, recording automatic digital optical tracker (RADOT) stations were installed. Helicopter pads appeared on Legan, Gellinam, Eniwetok, and Omelek in 1967. Also closely related to the Nike

Turrett of Meck Island Control Building, under construction.



program was an extensive and significant housing project carried out on Ebeye Island. Since missile operations required the evacuation of native Marshallese from certain areas of the atoll, the governments of the United States and the Trust Territory agreed on a master plan for an Ebeye Island housing development. Between 1964 and 1967, HED supervised MZC's construction of 77 four-family concrete houses, the necessary utility systems, and concrete cisterns. These permanent dwellings, complete with indoor plumbing, significantly raised the standard of living of the Marshallese people.

An even more recent development of the Nike-X, or Safeguard, program on yet another island in the Kwajalein atoll has involved plans for the construction of remote launching facilities on Illeginni, to the northwest of Meck. On 30 March 1970 HED awarded contract DACA83-70-C-0014 to MZC in the amount of $1,256,778 for mobilization and demobilization and the procurement of certain electrical and mechanical equipment for the remote launch support facilities to be erected on Illeginni. The complete program for this island is expected to include a launch mound with two Spartan and two Sprint cells, a universal missile building, camera stations, and a precise power plant, as part of the technical components, with a helicopter pad, water, sewage, and electrical utilities, a special vehicular storage building, an operations building, and fresh water and fuel oil storage tanks as the major support facilities. In addition, the contractor will develop a harbor, a personnel landing, and a concrete ramp. Total construction costs of the entire program for Illeginni were estimated in the spring of 1970 at approximately $10 million. When these facilities are completed, missiles launched from the remote site on Illeginni will be tracked by missile site radars in the MICB on Meck.

Especially concerned with Nike projects on all these sites in the Trust Territory of the Pacific (TTPI) was the Real Estate Division, which served as a unit of HED until 1962 and then as a division of POD. Since the establishment of Kwajalein as an Army command, the Honolulu real estate office has acted as agent for the U.S. Government in almost all United States real estate transactions in the Marshall Islands and in this function has worked closely with the U.S. Navy, the Department of Defense's official contact with the government of the TTPI. When so instructed by the Army command on Kwajalein, the Real Estate Division requests U.S. Navy forces at Pearl Harbor to acquire the specified property from the government of the Trust Territory, which then secures the land by leasehold from private owners, turns over the property to the Navy under a use and occupancy agreement, and reimburses the owners with a one-time payment from U.S. Government funds. The Navy then allows the Army to use the land so acquired. Because the Marshallese are completely dependent on their land, both economically and traditionally, and are thus extremely reluctant to sell their farms, real property in the Trust Territory is acquired by leasehold rather than in fee. Negotiations at various times over the past decade have resulted in fluctuating rates; recent records include some 99-year leases at $500 per acre for the lease term, some 25-year leases at $500, and some 99-year leases at $1,000. The Nike program in Kwajalein has thus introduced the Honolulu Engineers to a new dimension in the field of real estate, for real property transactions in the Trust Territory have involved only leaseholds, not fee acquisitions, and these negotiations have been influenced by native reluctance to part with land even on a leasehold basis.

HED's work in the Trust Territory has affected not only the Real Estate Division of POD but the entire Honolulu District as well. The start of Nike-Zeus construction in 1959 brought new life to the Honolulu Engineer office just two years after its reestablishment as a District, while the continued growth of Nike-Zeus, Project PRESS, and Nike-X during the next decade assured HED's place of honor within the Corps. The success of the program was especially notable because of the relatively small staff maintained by the District throughout the 1960's. Although by January 1970 the office had supervised the completion of over $145 million worth of Nike-related work in the Marshall Islands, its staff had not grown accordingly; during most of the decade approximately 200 employees handled the District's expanding workload. This small staff maintained excellent relations with the contractor and ensured that construction was completed on schedule.

The Kwajalein construction program not only drew national attention to HED but also exemplified the two themes of the District's history: diversity and flexibility. Within the Nike construction program itself, a great variety of tasks fell to the Honolulu District. Dredging and filling operations at Kwajalein and Meck, airfield clearing at Roi-Namur, the installation of precise radar equipment at all three islands, and the development of a housing project at Ebeye all kept HED involved in a wide range of activity at the atoll. In addition to these Nike projects, furthermore, the same years from 1957 to 1965 saw the District busy with Nike-Hercules launch pads and Capehart housing on Oahu, while civil works tasks included harbor development at Kawaihae, breakwater rehabilitation at Nawiliwili and Kahului, tsunami model studies at Look Laboratory, and flood control, beach erosion protection, and small boat harbor projects throughout Hawaii.

These last two chapters thus provide a fitting conclusion to the history of the Honolulu District's first six decades, for diversity has characterized the entire era. In 1910 the District Engineer supervised the construction of gun emplacements, the dredging of Honolulu and Hilo harbors, and the erection of the Makapuu lighthouse. A quarter of a century later the administration of PWA and then WPA joined the

ranks of HED's activities, while World War II saw the District's expansion into still newer fields, as the U.S. Engineers camouflaged local landmarks in Hawaii and planned supply operations for assaults on forward bases in the Pacific. After the Second World War, too, when the emphasis of HED's workload shifted from civil works to military construction, unusual projects in both areas continued to distinguish the District. The use of precast concrete tribars at Nawiliwili and the explosive excavations at Kawaihae found interesting counterparts in military projects such as the construction of Oahu's first Capehart housing units at Schofield Barracks and the whole range of Nike construction in the Marshall Islands. The Nike program also provided one more illustration of HED's geographic diversity: the Welles Harbor project at Midway in the 1930's, the supply plans for islands in the South Pacific during World War II, and the construction of radar and missile facilities at Kwajalein in the 1960's all extended the Honolulu District's activities far from the shores of Hawaii.

The flexibility of the District's response to the changing world situation has continued throughout the 1960's, too. The establishment of the Honolulu Engineer District in 1905 resulted largely from the start of construction of the Panama Canal, while the expansion of Honolulu Harbor a decade later stemmed partly from the opening of the Canal to traffic. The same pattern has characterized other civil works projects: harbor dredgings at Honolulu, Port Allen, and Kaunakakai in the 1930's were funded by a Depression-generated agency; the Kalihi entrance channel was excavated and the bascule bridge begun in the late 1950's because of increased commerce in Hawaii. Even the growth of the small boat harbor program and of plans for beach erosion protection in the 1960's could be traced to the rise in national living standards as many local residents acquired pleasure craft and mainland tourists flocked to Waikiki.

An even more dramatic pattern of response to changing situations has appeared in the history of HED's military construction activities over the same six decades. Prior to the 1930's, HED's defense program involved the construction of seacoast gun batteries, for ships, after all, were the primary means of enemy attack in those early years. When seaplane clippers began flying in the 1930's, the District planned to construct seaplane runways at Keehi Lagoon and to dredge a calm harbor at Welles to service potentially defensive American aircraft. The outbreak of World War II and the transfer of all Army and Air Corps construction to the Corps of Engineers signaled a tremendous increase in the District's military construction program and also redirected HED's defense efforts. Now the U.S. Engineers hastened to pave new airfields and to dig tunnels and bunkers as protection against land-based, bomb-laden airplanes. Leading to an extensive construction program of recreational facilities and housing projects, too, was the establishment of a peacetime standing army within a decade after World War II. Nike-Hercules continued to strengthen Oahu's defenses against manned aircraft in the late 1950's, while the construction of Nike-Zeus and Nike-X research and development facilities reflected a shift from anti-aircraft to anti-missile defense. In altering Nike-Zeus facilities for use with Nike-X's more modern missiles, furthermore, the District again exhibited its adaptability to new situations. HED's military construction program from 1905 to 1965 has thus reflected the world's changing methods of warfare. In military construction as in civil works, flexibility and diversity have characterized the first six decades of the history of the Honolulu Engineer District.

Footnotes — Chapter X

1. U.S. Army Engineer Division, Pacific Ocean, and U.S. Army Engineer District, Honolulu, **POD-HED Patter**, November 1959, p. 5.
2. Pacific-Martin-Zachry, **Operation Nike-Zeus: Marshall Islands: Missile and Radar Base Installations** (Honolulu, 1962).

BIBLIOGRAPHY

U.S. Army Corps of Engineers records and reports

Annual Report of the Chief of Engineers on Civil Works Activities. Washington, 1899-1967.

Office of the Chief of Engineers. **Compendium of Information Concerning the History, Present Mission and Activities of the Corps of Engineers.** Washington, 1955.

U.S. Army Engineer Area, Honolulu. **50th Anniversary: Historical Review.** Honolulu, 1955.

U.S. Army Engineer Area, Honolulu. Files stored at Federal Records Center, St. Louis. 1950-1954.

U.S. Army Engineer District, Honolulu. "Civil Works Program: Uncompleted Authorized Projects: Description and Status, 1 July 1969." Honolulu, 1969.

U.S. Army Engineer District, Honolulu. **Cooperative Beach Erosion Control Study: Waikiki Beach, Oahu, Hawaii.** Honolulu, 1963.

U.S. Army Engineer District, Honolulu. Files of completed contracts. 1954-1966.

U.S. Army Engineer District, Honolulu. General and Special orders. 1959-1969.

U.S. Army Engineer District, Honolulu. **Information Brochure.** Honolulu, 1967.

U.S. Army Engineer District, Honolulu. **Information Brochure Prepared for the Command Inspection Team Representing the Chief of Engineers.** Honolulu, 1966.

U.S. Army Engineer District, Honolulu. **Interim Report on Survey of the Coasts of the Hawaiian Islands: Harbors for Light-Draft Vessels.** Honolulu, 1963.

U.S. Army Engineer District, Honolulu. "The New Tripler Hospital." Honolulu, 1947.

U.S. Army Engineer District, Honolulu. Organization Charts. 1944-1960.

U.S. Army Engineer District, Honolulu. **Real Estate Planning Report for Hawaii Defense Area: Nike Batteries Nos. 1 through 8.** Honolulu, 1959.

U.S. Army Engineer District, Honolulu. **Review Report on Survey of Hilo Harbor.** Honolulu, 1957.

U.S. Army Engineer District, Honolulu. **Study of Proposed Barrier Plans for the Protection of the City of Hilo and Hilo Harbor, Hawaii.** Honolulu, 1957.

U.S. Army Engineer Division, Pacific Ocean. General and Special Orders. 1957-1969.

U.S. Army Engineer Division, Pacific Ocean. "History of Kwajalein Contracting." Honolulu, 1966

U.S. Army Engineer Division, Pacific Ocean. **Information Bulletin.** Honolulu, 1968.

U.S. Army Engineer Division, Pacific Ocean. Real Estate Files. 1919-1966.

U.S. Army Engineer Division, Pacific Ocean. **Water Resources Development by the Corps of Engineers in the Hawaiian Islands.** Honolulu, 1967.

U.S. Army Engineer Waterways Experiment Station, Vicksburg. **Stability of Rubble-Mound Tsunami Barrier: Hilo Harbor, Hawaii.** Vicksburg, 1967.

U.S. Government records and reports other than Corps of Engineer publications.

Construction Service, Central Pacific Base Command. **Historical Review Covering Activities of Construction Service, Central Pacific Base Command.** Honolulu (?), 1945 (?).

Hawaiian Department, U.S. War Department. **History of the Hawaiian Department: 1898-1941.** Fort Shafter, Oahu, 1941.

Hawaiian Division, U.S. War Department. **History of the United States Army in Hawaii: 1849 to 1939.** Schofield Barracks, Oahu, 1939.

U.S. Army Forces, Middle Pacific. **Historical Record of Engineer Activities in Middle Pacific Area from 7 December 1941 to 2 September 1945.** Honolulu, 1945. 3 vols.

U.S. Army Ordnance Missile Command. **General Information: Tour of Nike-Zeus Test Ranges: 29 July — 7 August 1959.** Redstone Arsenal, 1959.

U.S. Army Ordnance Missile Command. **Briefing: Test Program, Kwajalein Island.** Redstone Arsenal, 1959 (?).

U.S. Army, Pacific. Files of installations in Hawaii.

U. S. Army, Pacific. **The Army in Hawaii.** n.d.

U.S. Army Sentinel System Command. **Analysis of Existing Facilities: Kwajalein Missile Range.** Kwajalein (?), 1968.

U.S. Congress. **Hearings before the Joint Committee on the Investigation of the Pearl Harbor Attack.** 79th Cong., 1st sess. Washington, 1946. 39 vols.

U.S. Congress House Committee on Public Works. **Inspection Trip: Civil Works Projects: Hawaiian Islands.** Washington (?), 1947.

U.S. Congress. **House Documents on Rivers and Harbors.** 1905-1966.

Young, Senator Stephen M. **Report to the Committee on Public Works, U.S. Senate: River and Harbor, Flood Control, and Beach Erosion Control Projects in the State of Hawaii.** Washington, 1968.

Published works.

Allen, Gwenfread. **Hawaii's War Years: 1941-1945.** Honolulu, 1950.

Dod, Karl C. **United States Army in World War II: The Technical Services: The Corps of Engineers: The War Against Japan.** Washington, 1966.

Hodge, Clarence L., ed. **War Workers in Hawaii: A Pictorial Record of Their Work, Play and Achievements.** Honolulu, 1942.

Hodge, Clarence L. and Peggy Ferris. **Building Honolulu: A Century of Community Service.** Honolulu, 1950.

Kauai Chamber of Commerce. **Nawiliwili Breakwater and Harbor Project.** Lihue, 1928.

Pacific-Martin-Zachry. **Operation Nike-Zeus: Marshall Islands: Missile and Radar Base Installations.** Honolulu, 1962.

Potter, Norris Whitfield. **The Punahou Story.** Palo Alto, 1969.

Articles.

"The Death of Nike-Zeus," **Saturday Evening Post,** 1 June 1963.

"Decision Time Grows Shorter for Nike-X," **Aviation Week and Space Technology,** 15 March 1965.

"Defense Group Evaluates Zeus Potential," **Aviation Week,** 2 November 1959.

"DOD Emphasizes Nike-X Anti Missile," **Aviation Week,** 11 March 1963.

"Martin Co. Will Develop Sprint Missile for New Nike-X System," **Aviation Week,** 25 March 1963.

Newsweek, 27 March 1961, p. 64.

"Nike-Zeus to Try Its Anti-Missile Ability," **Business Week,** 19 March 1960.

Pacific-Martin-Zachry. Log of Project Superintendent, Roi-Namur, 1960-1961. Unpublished.

Palmer, Robert Q. "Breakwaters in the Hawaiian Islands," **Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers**. New York, 1960.

Rush, B. F. **History of Construction and Development: Commercial Harbors, Territory of Hawaii**. Honolulu, 1957.

"Senate Rejects Nike-Zeus Production," **Aviation Week**, 22 April 1963.

"Sprint Anti-Missile Tests to Begin," **Aviation Week**, 16 March 1964.

"Zeus Delayed by Technical Doubt, Budget," **Aviation Week**, 8 February 1960.

"Zeus on Kwajalein," **Time**, 19 May 1961.

Periodicals.

Construction Service, Central Pacific Base Command. **CNS Review**. Honolulu, 1945.

The Honolulu Advertiser. Honolulu, 1921-1967.

The Honolulu Star-Bulletin. Honolulu, 1921-1967.

The Pacific Commercial Advertiser. Honolulu, 1899-1921.

Paradise of the Pacific. Honolulu, 1904-1966.

Thrum, Thomas G. **The Hawaiian Annual**. Honolulu, 1904-1969.

U.S. Army Engineer District, Honolulu. **Safety/The Trade Wind**. Honolulu, 1941-1943.

U.S. Army Engineer District, Honolulu. **The Trade Wind**. Honolulu, 1939-1940.

U.S. Army Engineer District, San Francisco. **The Parapet**. San Francisco, 1955-1956.

U.S. Army Engineer Division, Pacific Ocean, and U.S. Army Engineer District, Honolulu. **POD-HED Patter**. Honolulu, 1959-1961.

Miscellaneous.

Oahu Telephone Directory. 1911-1945.

Polk-Husted Directory Company. **Directory of Honolulu and the Territory of Hawaii**. Honolulu, 1904-1941.

Territory and State of Hawaii. Correspondence between Governors and U.S. Engineers. 1903-1962.

Interviews with present and retired personnel of Honolulu Engineer District.

BIBLIOGRAPHICAL NOTE

The accompanying bibliography provides a record of works consulted in compiling this history, while this note offers a brief summary of the availability of those sources. Researching the Honolulu Engineer District's history has proven a challenge; the abundance of material on the World War II period and the 1960's has been balanced by a scarcity of information on most other eras of HED's history. After 1923 the Annual Reports do not include the District's fortification duties, for example; similarly, HED's files of construction contracts completed before 1954 have been retired. The slow pace of the 1920's and the early 1950's has also no doubt contributed to the paucity of material available on the District's activities in those years.

Because of Oahu's important role in the Second World War, information on the Engineers' work in that period abounds. The three-volume MIDPAC history of Engineer activities in World War II and Karl C. Dod's work on the same subject cover the war era thoroughly, while the books by Gwenfread Allen and Norris Whitfield Potter offer equally valuable accounts of local reaction to the Engineers after the attack on Pearl Harbor. Also relatively abundant is information on civil works projects throughout the century, for the Annual Reports and House Documents provide authoritative accounts of these activities, and recent reports by the District's civil works branch describe major projects in detail. Much information is also available on HED's Nike construction work in Kwajalein.

For earlier military construction activities and for changes in the District's organization, an interesting variety of sources has proven useful. Office newspapers depict the spirit as well as the workings of the District, while local telephone directories have been the only certain sources of the office's location at various times in the District's history. Honolulu newspaper articles have helped to fill in the gaps in military construction activities after World War II and have provided valuable information on PWA and WPA activities in the 1930's. The files of the Governors of the Territory and State of Hawaii have proven an unexpected and important source of material on almost all aspects of the District's history.

Personal interviews with many current District employees have also been very helpful. In addition, three former District Engineers, Colonel John R. Clifton, Colonel Bartley M. Harloe, and Major General S. L. Scott, have contributed to this work, while other rewarding interviews were with Major General Edmond H. Leavey and Colonel Charles S. Marek. Special appreciation is also due Mrs. Jean Dabagh and the rest of the staff of the Public Archives of Hawaii, where such valuable sources of information as the telephone directories, monthly and annual magazines, newspaper indices, and the Governors' correspondence files are located. The variety of references consulted at the Archives and in the District office has added to the challenge of researching material for this history of HED.

APPENDIX A: DISTRICT ENGINEERS

HONOLULU DISTRICT ENGINEERS

First Lieutenant John R. Slattery
April 1905 — December 1906
Captain C. W. Otwell
December 1906 — November 1908
Major E. Eveleth Winslow
November 1908 — March 1911
Captain A. B. Putnam
March 1911 — July 1911
Major William P. Wooten
July 1911 — July 1914
Lieutenant Colonel Charles S. Bromwell
July 1914 — December 1915
Captain Charles J. Taylor
December 1915 — February 1916
Major R. R. Raymond
February 1916 — September 1917
Captain W. H. Britton
September 1917 — November 1917
Colonel Thomas H. Rees
November 1917 — December 1917
Captain W. H. Britton
December 1917 — January 1918
Lieutenant Colonel R. R. Raymond
January 1918 — March 1919
Colonel H. C. Newcomer
March 1919 — August 1920
Colonel C. A. F. Flagler
August 1920 — January 1921
Captain H. M. Underwood
January 1921 — February 1921
Colonel C. A. F. Flagler
February 1921 — March 1921
Major W. A. Johnson
March 1921 — October 1923
Colonel Edward H. Schulz
October 1923 — November 1923
Major W. H. Lanagan
November 1923 — March 1926
Major W. C. Lemen
March 1926 — September 1926
Major Earl North
September 1926 — May 1929
Captain S. L. Damon
May 1929 — September 1929
Major R. W. Crawford
September 1929 — September 1931
Major S. L. Scott
September 1931 — August 1934
Major R. G. Barrows
August 1934 — July 1936
Lieutenant Colonel R. C. Crawford
July 1936 — July 1937
Captain L. T. Ross
July 1937 — November 1937
Major Peter E. Bermel
November 1937 — July 1940
Lieutenant Colonel Theodore Wyman, Jr.
July 1940 — March 1942
Colonel Albert K. B. Lyman
March 1942 — August 1942
Colonel Holland L. Robb
August 1942 — September 1942
Brigadier General Hans Kramer
September 1942 — April 1944
Colonel Benjamin R. Wimer
April 1944 — April 1945
Colonel Claude H. Chorpening
May 1945 — December 1945
Colonel George J. Zimmerman
December 1945
Colonel Charles J. Jeffus
December 1945
Brigadier General Bernard L. Robinson
December 1945 — June 1947
Colonel Bartley M. Harloe
June 1947 — September 1949
Colonel F. H. Falkner
September 1949 — July 1950

HONOLULU AREA ENGINEERS

Colonel F. H. Falkner
August 1950 — August 1951
Lieutenant Colonel David M. Matheson
August 1951 — October 1953
Lieutenant Colonel Sidney Shelley
October 1953 — August 1956
Lieutenant Colonel McGlachlin Hatch
August 1956 — June 1957

HONOLULU DISTRICT ENGINEERS

Lieutenant Colonel McGlachlin Hatch
July 1957 — June 1959
Colonel John R. Clifton
June 1959 — June 1961
Colonel Donald G. Williams
June 1961 — July 1963
Colonel Glenn P. Ingwersen
July 1963 — June 1966
Colonel William F. Roos
June 1966 — August 1968
Lieutenant Colonel C. S. Romedy, Jr.
August 1968 — November 1968
Colonel John A. Hughes
November 1968 —

APPENDIX B: MAPS OF HAWAII

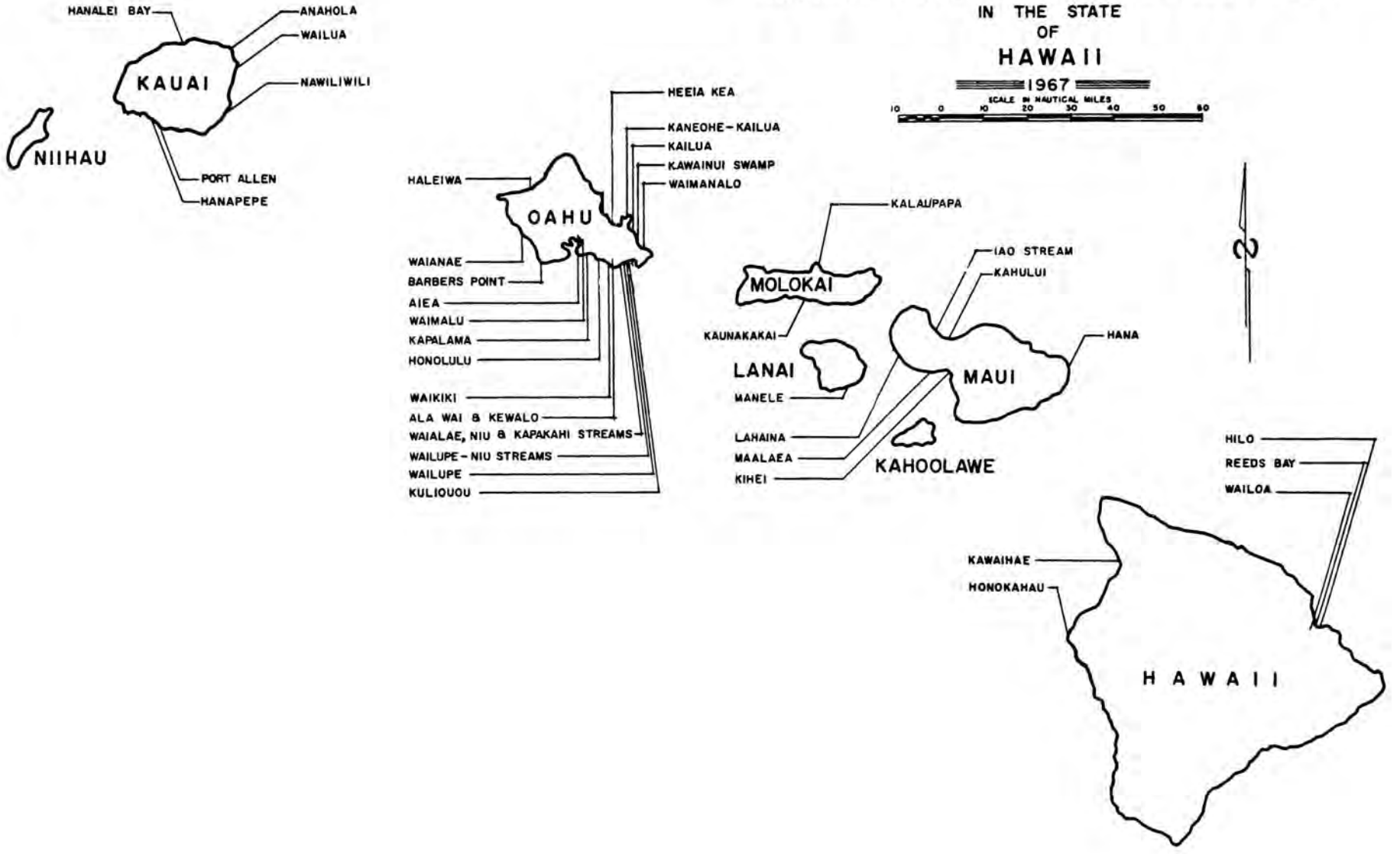
CORPS OF ENGINEERS

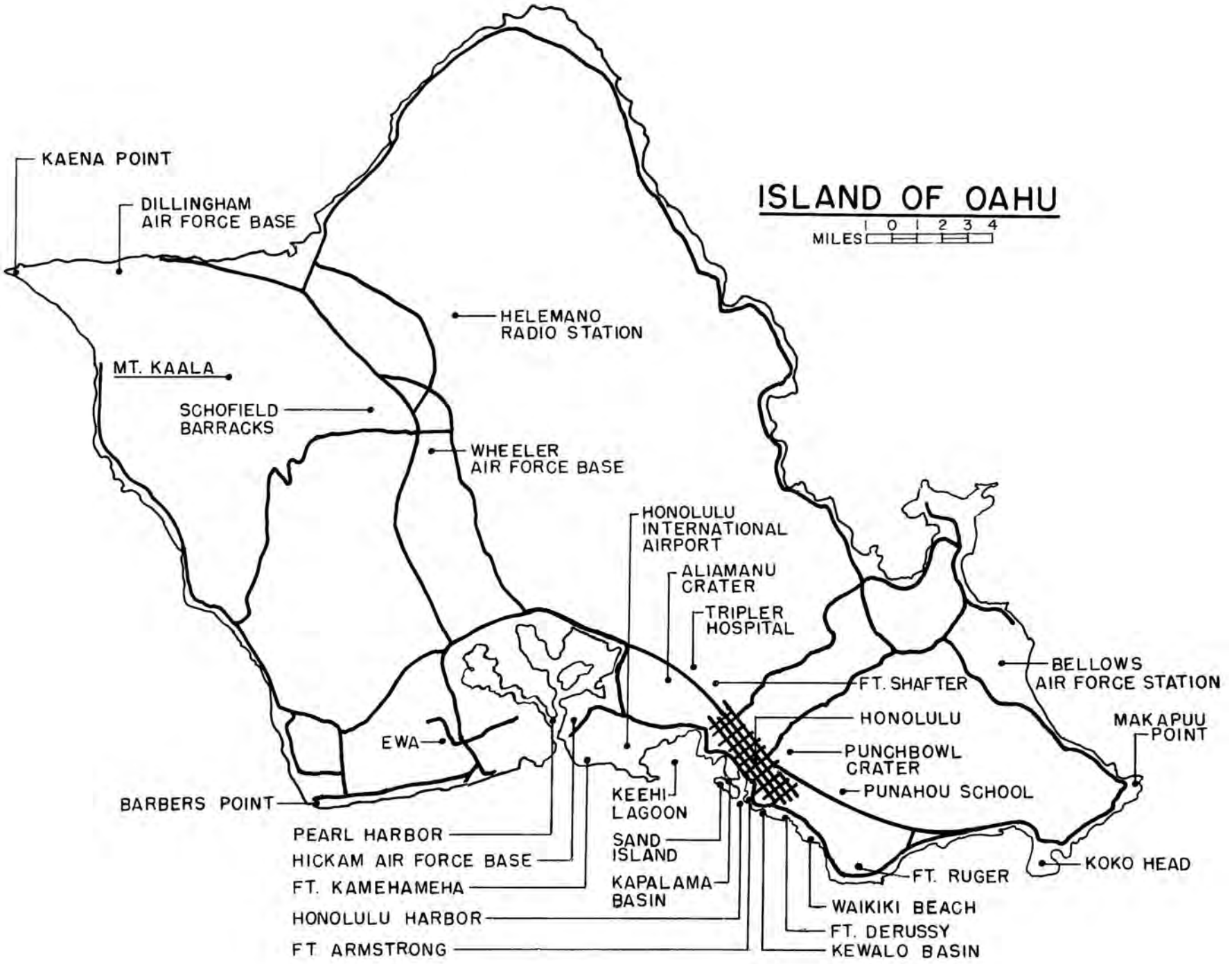
WATER RESOURCES DEVELOPMENT

IN THE STATE
OF
HAWAII

1967

SCALE IN NAUTICAL MILES
10 0 10 20 30 40 50 60

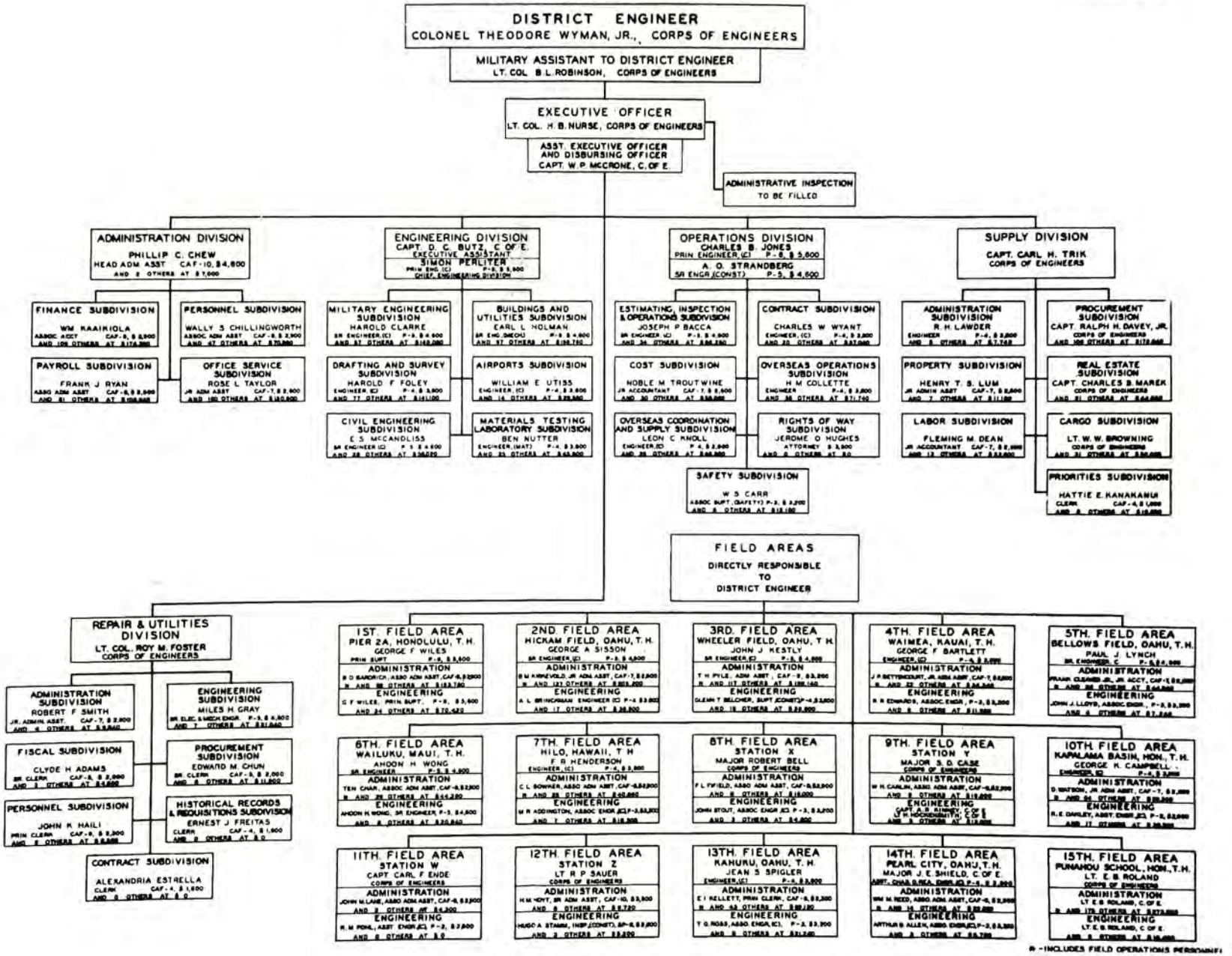



ISLAND OF OAHU
MILES 1 0 1 2 3 4
KAENA POINT
DILLINGHAM AIR FORCE BASE
HELEMANO RADIO STATION
MT. KAALA
SCHOFIELD BARRACKS
WHEELER AIR FORCE BASE
HONOLULU INTERNATIONAL AIRPORT
ALIAMANU CRATER
TRIPLER HOSPITAL
FT. SHAFTER
BELLOWS AIR FORCE STATION
HONOLULU
MAKAPUU POINT
EWA
PUNCHBOWL CRATER
PUNAHOU SCHOOL
BARBERS POINT
KEEHI LAGOON
PEARL HARBOR
SAND ISLAND
HICKAM AIR FORCE BASE
KOKO HEAD
FT. KAMEHAMEHA
KAPALAMA BASIN
FT. RUGER
HONOLULU HARBOR
WAIKIKI BEACH
FT. DERUSSY
FT ARMSTRONG
KEWALO BASIN

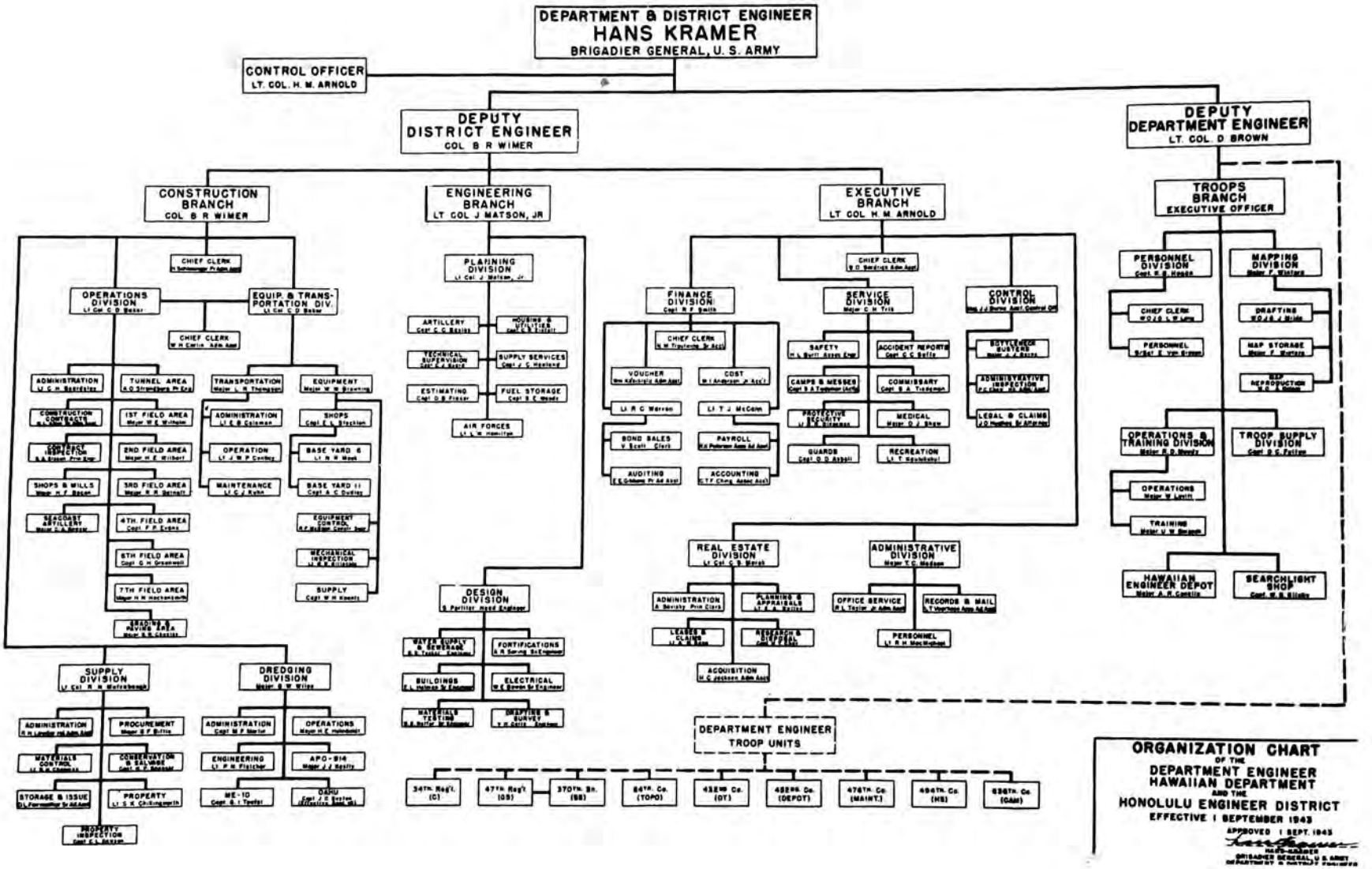
APPENDIX C: ORGANIZATION CHARTS, WORLD WAR II

HONOLULU ENGINEER DISTRICT
ORGANIZATION CHART

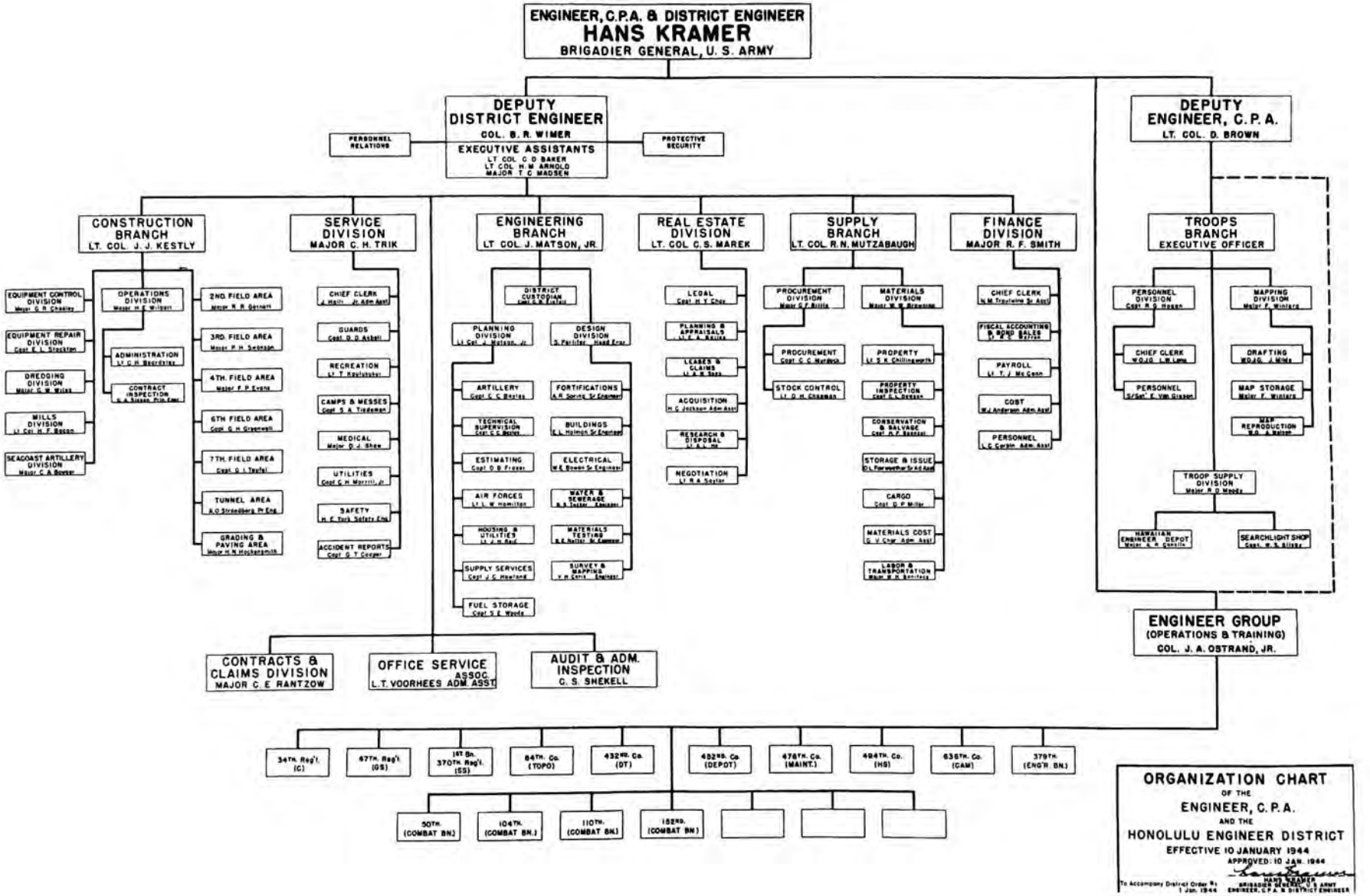
8 February 1942

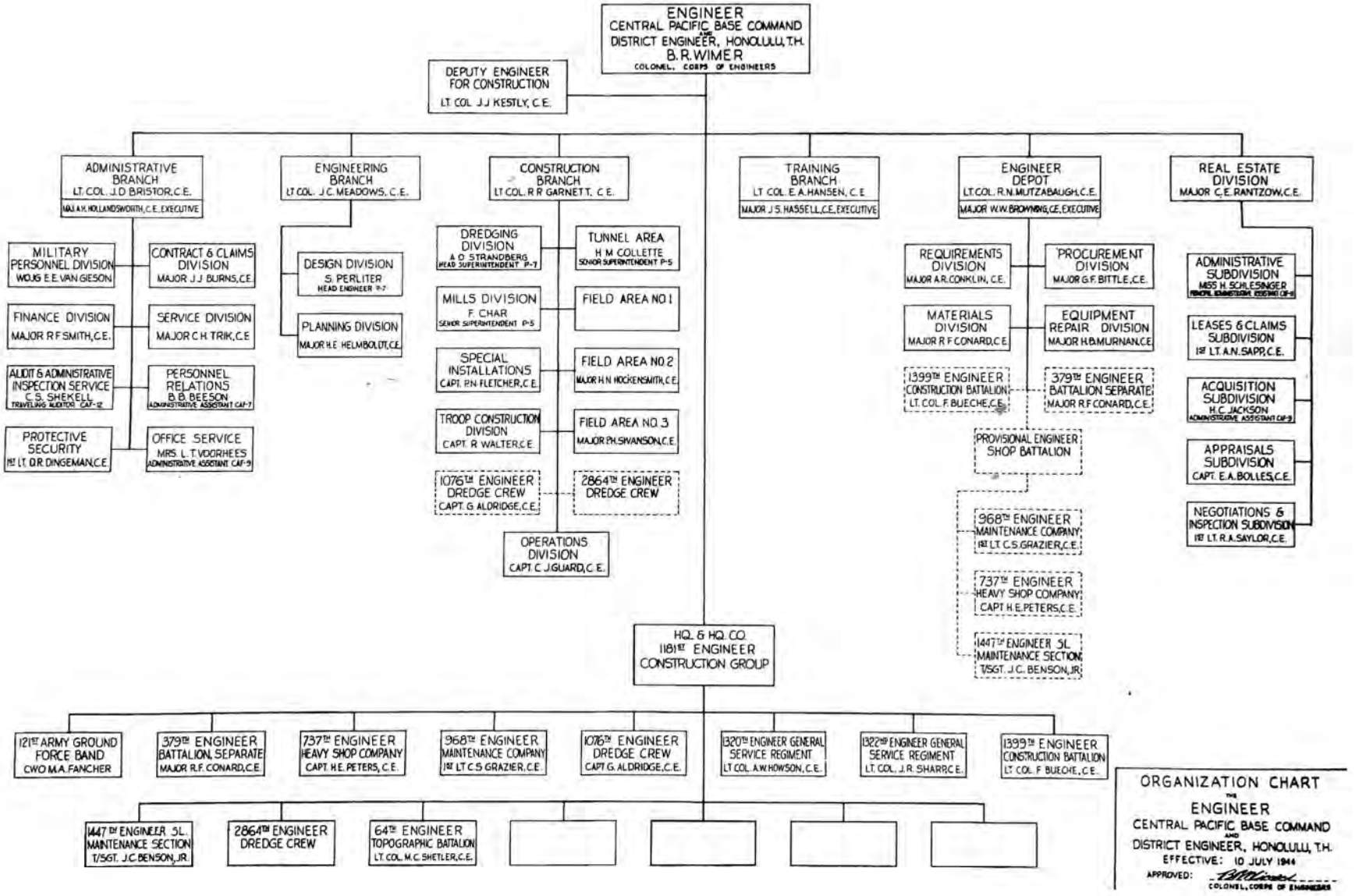


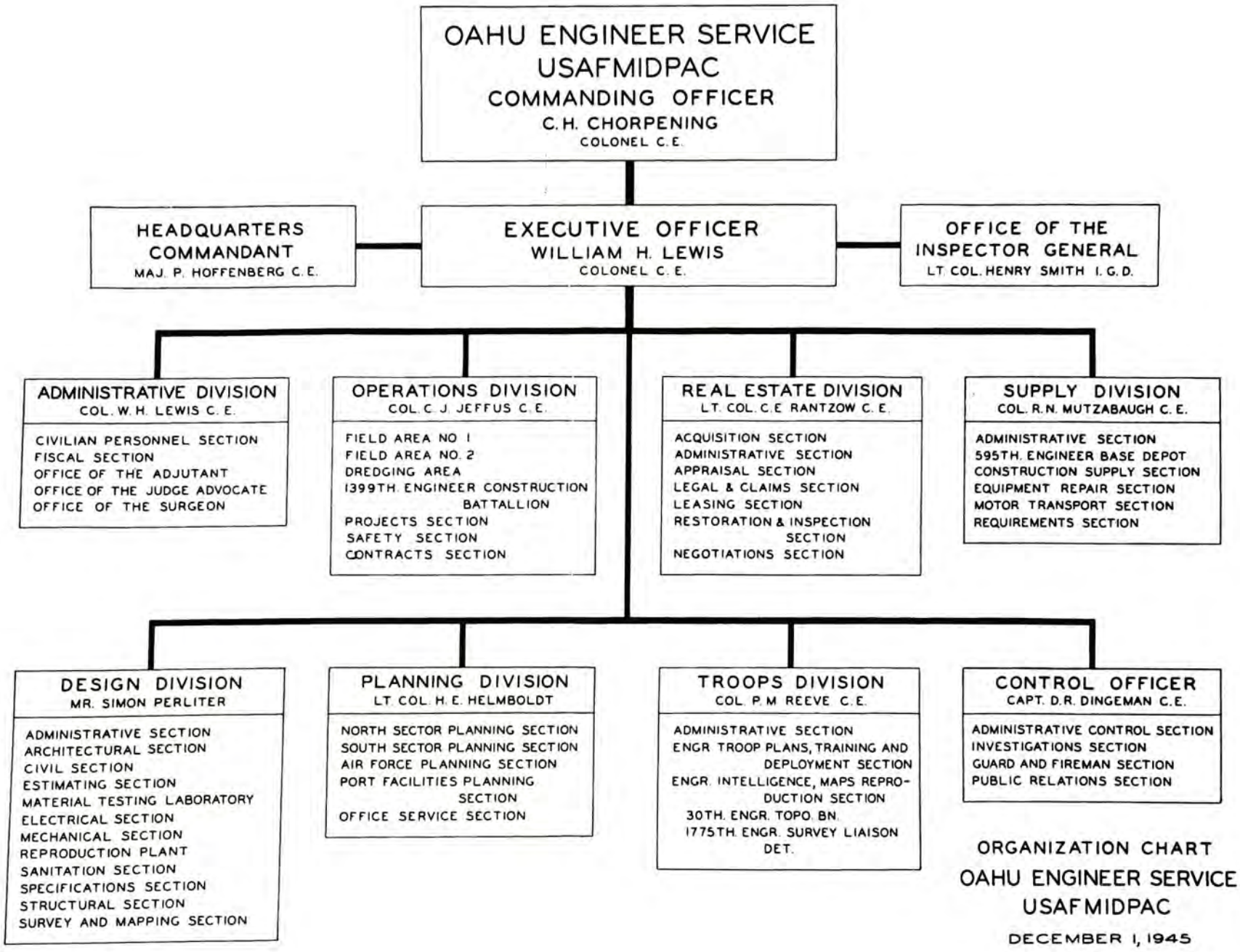
R - INCLUDES FIELD OPERATIONS PERSONNEL



ORGANIZATION CHART
OF THE
DEPARTMENT ENGINEER
HAWAIIAN DEPARTMENT
AND THE
HONOLULU ENGINEER DISTRICT
EFFECTIVE 1 SEPTEMBER 1943
APPROVED 1 SEPT. 1943
BRIGADIER GENERAL, U. S. ARMY


ENGINEER, C.P.A. & DISTRICT ENGINEER
HANS KRAMER
BRIGADIER GENERAL, U. S. ARMY
DEPUTY DISTRICT ENGINEER
COL. B. R. WIMER
EXECUTIVE ASSISTANTS
LT COL C D BAKER
LT COL H M ARNOLD
MAJOR T C MADSEN
PERSONNEL RELATIONS
PROTECTIVE SECURITY
DEPUTY ENGINEER, C. P. A.
LT. COL. D. BROWN
CONSTRUCTION BRANCH
LT. COL. J. J. KESTLY
SERVICE DIVISION
MAJOR C. H. TRIK
ENGINEERING BRANCH
LT. COL. J. MATSON, JR.
REAL ESTATE DIVISION
LT. COL C. S. MAREK
SUPPLY BRANCH
LT. COL. R. N. MUTZABAUGH
FINANCE DIVISION
MAJOR R. F. SMITH
TROOPS BRANCH
EXECUTIVE OFFICER
EQUIPMENT CONTROL DIVISION
EQUIPMENT REPAIR DIVISION
DREDGING DIVISION
MILLS DIVISION
SEACOAST ARTILLERY DIVISION
OPERATIONS DIVISION
ADMINISTRATION
CONTRACT INSPECTION
2ND. FIELD AREA
3RD. FIELD AREA
4TH. FIELD AREA
6TH FIELD AREA
7TH. FIELD AREA
TUNNEL AREA
GRADING & PAVING AREA
CHIEF CLERK
GUARDS
RECREATION
CAMPS & MESSES
MEDICAL
UTILITIES
SAFETY
ACCIDENT REPORTS
DISTRICT CUSTODIAN
PLANNING DIVISION
DESIGN DIVISION
ARTILLERY
TECHNICAL SUPERVISION
ESTIMATING
AIR FORCES
HOUSING & UTILITIES
SUPPLY SERVICES
FUEL STORAGE
FORTIFICATIONS
BUILDINGS
ELECTRICAL
WATER & SEWERAGE
MATERIALS TESTING
SURVEY & MAPPING
LEGAL
PLANNING & APPRAISALS
LEASES & CLAIMS
ACQUISITION
RESEARCH & DISPOSAL
NEGOTIATION
PROCUREMENT DIVISION
PROCUREMENT
STOCK CONTROL
MATERIALS DIVISION
PROPERTY
PROPERTY INSPECTION
CONSERVATION & SALVAGE
STORAGE & ISSUE
CARGO
MATERIALS COST
LABOR & TRANSPORTATION
CHIEF CLERK
FISCAL ACCOUNTING & BOND SALES
PAYROLL
COST
PERSONNEL
PERSONNEL DIVISION
CHIEF CLERK
PERSONNEL
MAPPING DIVISION
DRAFTING
MAP STORAGE
MAP REPRODUCTION
TROOP SUPPLY DIVISION
HAWAIIAN ENGINEER DEPOT
SEARCHLIGHT SHOP
ENGINEER GROUP
(OPERATIONS & TRAINING)
COL. J. A. OSTRAND, JR.
CONTRACTS & CLAIMS DIVISION
MAJOR C. E. RANTZOW
OFFICE SERVICE
ASSOC. L.T. VOORHEES ADM. ASST
AUDIT & ADM. INSPECTION
C. S. SHEKELL
34TH. Reg't. (C)
67TH. Reg't. (GS)
1ST Bn. 370TH. Reg't. (SS)
84TH. Co. (TOPO)
432ND. Co. (DT)
482ND. Co. (DEPOT)
476TH. Co. (MAINT.)
494TH. Co. (HS)
636TH. Co. (CAM)
379TH. (ENG'R. BN.)
50TH. (COMBAT BN.)
104TH. (COMBAT BN.)
110TH. (COMBAT BN.)
152ND. (COMBAT BN.)
ORGANIZATION CHART
OF THE
ENGINEER, C. P. A.
AND THE
HONOLULU ENGINEER DISTRICT
EFFECTIVE 10 JANUARY 1944
APPROVED: 10 JAN. 1944
HANS KRAMER
BRIGADIER GENERAL, U. S. ARMY
ENGINEER, C.P.A. & DISTRICT ENGINEER
To Accompany District Order No.
1 Jan. 1944

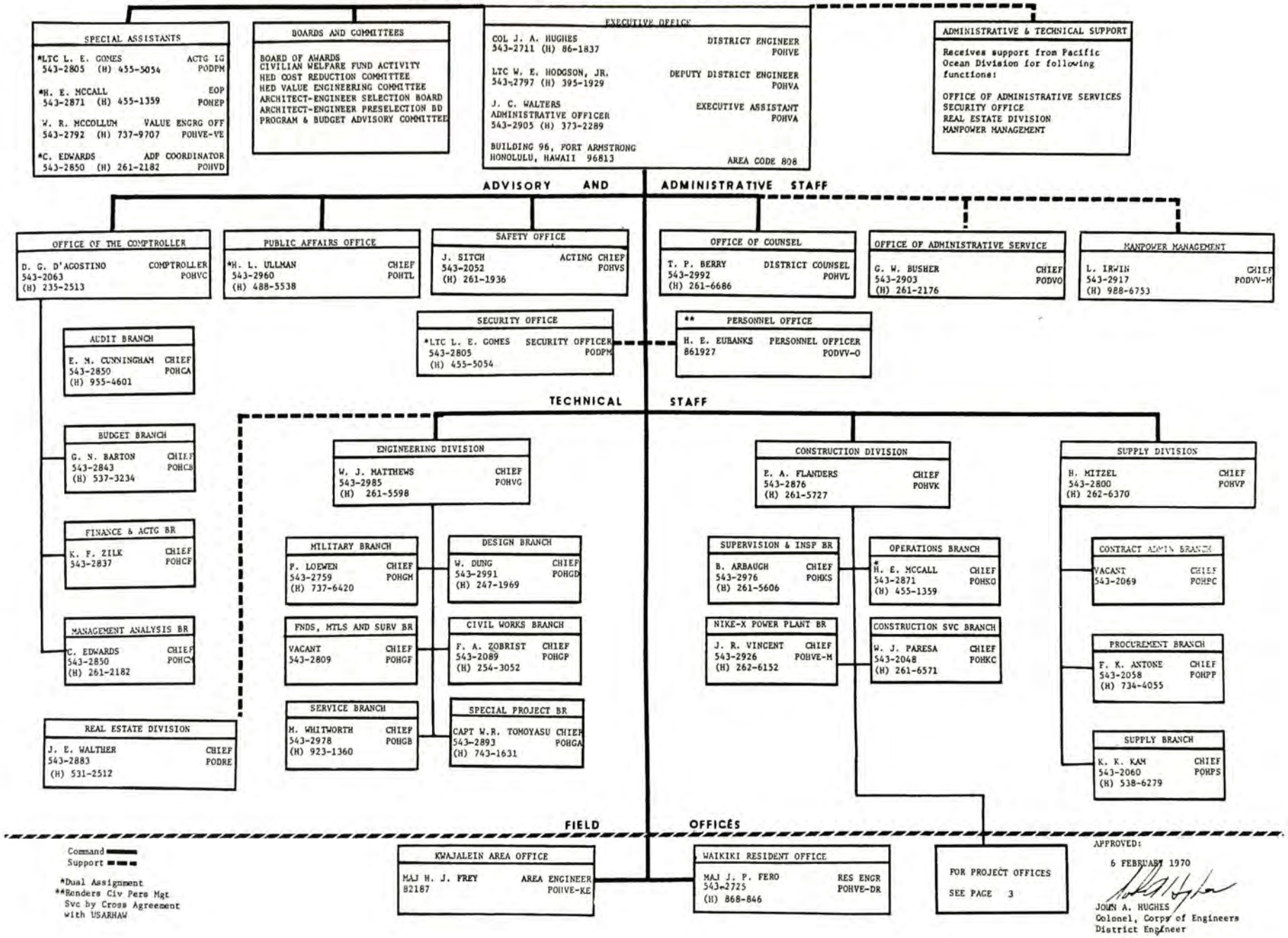

ENGINEER
CENTRAL PACIFIC BASE COMMAND
AND
DISTRICT ENGINEER, HONOLULU, T.H.
B. R. WIMER
COLONEL, CORPS OF ENGINEERS
DEPUTY ENGINEER FOR CONSTRUCTION
LT. COL. J. J. KESTLY, C.E.
ADMINISTRATIVE BRANCH
LT. COL. J. D. BRISTOR, C.E.
MAJ. A. H. HOLLANDSWORTH, C.E., EXECUTIVE
MILITARY PERSONNEL DIVISION
WO JG E. E. VAN GIESON
CONTRACT & CLAIMS DIVISION
MAJOR J. J. BURNS, C.E.
FINANCE DIVISION
MAJOR R. F. SMITH, C.E.
SERVICE DIVISION
MAJOR C. H. TRIK, C.E.
AUDIT & ADMINISTRATIVE INSPECTION SERVICE
C. S. SHEKELL
TRAVELING AUDITOR CAF-12
PERSONNEL RELATIONS
B. B. BEESON
ADMINISTRATIVE ASSISTANT CAF-7
PROTECTIVE SECURITY
1ST LT. D. R. DINGEMAN, C.E.
OFFICE SERVICE
MRS. L. T. VOORHEES
ADMINISTRATIVE ASSISTANT CAF-5
ENGINEERING BRANCH
LT. COL. J. C. MEADOWS, C.E.
DESIGN DIVISION
S. PERLITER
HEAD ENGINEER P-7
PLANNING DIVISION
MAJOR H. E. HELMBOLDT, C.E.
CONSTRUCTION BRANCH
LT. COL. R. R. GARNETT, C.E.
DREDGING DIVISION
A. O. STRANDBERG
HEAD SUPERINTENDENT P-7
TUNNEL AREA
H. M. COLLETTE
SENIOR SUPERINTENDENT P-5
MILLS DIVISION
F. CHAR
SENIOR SUPERINTENDENT P-5
FIELD AREA NO. 1
SPECIAL INSTALLATIONS
CAPT. P. N. FLETCHER, C.E.
FIELD AREA NO. 2
MAJOR H. N. HOCKENSMITH, C.E.
TROOP CONSTRUCTION DIVISION
CAPT. R. WALTER, C.E.
FIELD AREA NO. 3
MAJOR P. H. SWANSON, C.E.
1076TH ENGINEER DREDGE CREW
CAPT. G. ALDRIDGE, C.E.
2864TH ENGINEER DREDGE CREW
OPERATIONS DIVISION
CAPT. C. J. GUARD, C.E.
TRAINING BRANCH
LT. COL. E. A. HANSEN, C.E.
MAJOR J. S. HASSELL, C.E., EXECUTIVE
ENGINEER DEPOT
LT. COL. R. N. MUTZABAUGH, C.E.
MAJOR W. W. BROWNING, C.E., EXECUTIVE
REQUIREMENTS DIVISION
MAJOR A. R. CONKLIN, C.E.
PROCUREMENT DIVISION
MAJOR G. F. BITTLE, C.E.
MATERIALS DIVISION
MAJOR R. F. CONARD, C.E.
EQUIPMENT REPAIR DIVISION
MAJOR H. B. MURNAN, C.E.
1399TH ENGINEER CONSTRUCTION BATTALION
LT. COL. F. BUECHE, C.E.
379TH ENGINEER BATTALION SEPARATE
MAJOR R. F. CONARD, C.E.
PROVISIONAL ENGINEER SHOP BATTALION
968TH ENGINEER MAINTENANCE COMPANY
1ST LT. C. S. GRAZIER, C.E.
737TH ENGINEER HEAVY SHOP COMPANY
CAPT. H. E. PETERS, C.E.
1447TH ENGINEER SL. MAINTENANCE SECTION
T/SGT. J. C. BENSON, JR.
REAL ESTATE DIVISION
MAJOR C. E. RANTZOW, C.E.
ADMINISTRATIVE SUBDIVISION
MISS H. SCHLESINGER
PRINCIPAL STENOTYPIST, CAF-5
LEASES & CLAIMS SUBDIVISION
1ST LT. A. N. SAPP, C.E.
ACQUISITION SUBDIVISION
H. C. JACKSON
ADMINISTRATIVE ASSISTANT CAF-9
APPRAISALS SUBDIVISION
CAPT. E. A. BOLLES, C.E.
NEGOTIATIONS & INSPECTION SUBDIVISION
1ST LT. R. A. SAYLOR, C.E.
HQ. & HQ. CO.
1181ST ENGINEER CONSTRUCTION GROUP
121ST ARMY GROUND FORCE BAND
CWO M. A. FANCHER
379TH ENGINEER BATTALION, SEPARATE
MAJOR R. F. CONARD, C.E.
737TH ENGINEER HEAVY SHOP COMPANY
CAPT. H. E. PETERS, C.E.
968TH ENGINEER MAINTENANCE COMPANY
1ST LT. C. S. GRAZIER, C.E.
1076TH ENGINEER DREDGE CREW
CAPT. G. ALDRIDGE, C.E.
1320TH ENGINEER GENERAL SERVICE REGIMENT
LT. COL. A. W. HOWSON, C.E.
1322ND ENGINEER GENERAL SERVICE REGIMENT
LT. COL. J. R. SHARR, C.E.
1399TH ENGINEER CONSTRUCTION BATTALION
LT. COL. F. BUECHE, C.E.
1447TH ENGINEER SL. MAINTENANCE SECTION
T/SGT. J. C. BENSON, JR.
2864TH ENGINEER DREDGE CREW
64TH ENGINEER TOPOGRAPHIC BATTALION
LT. COL. M. C. SHETLER, C.E.
ORGANIZATION CHART
THE
ENGINEER
CENTRAL PACIFIC BASE COMMAND
AND
DISTRICT ENGINEER, HONOLULU, T.H.
EFFECTIVE: 10 JULY 1944
APPROVED:
COLONEL, CORPS OF ENGINEERS



ORGANIZATION CHART
OAHU ENGINEER SERVICE
USAFMIDPAC
DECEMBER 1, 1945

APPENDIX D: ORGANIZATION CHART, 1970

US ARMY ENGINEER DISTRICT, HONOLULU



APPROVED:

6 FEBRUARY 1970

JOHN A. HUGHES
Colonel, Corps of Engineers
District Engineer